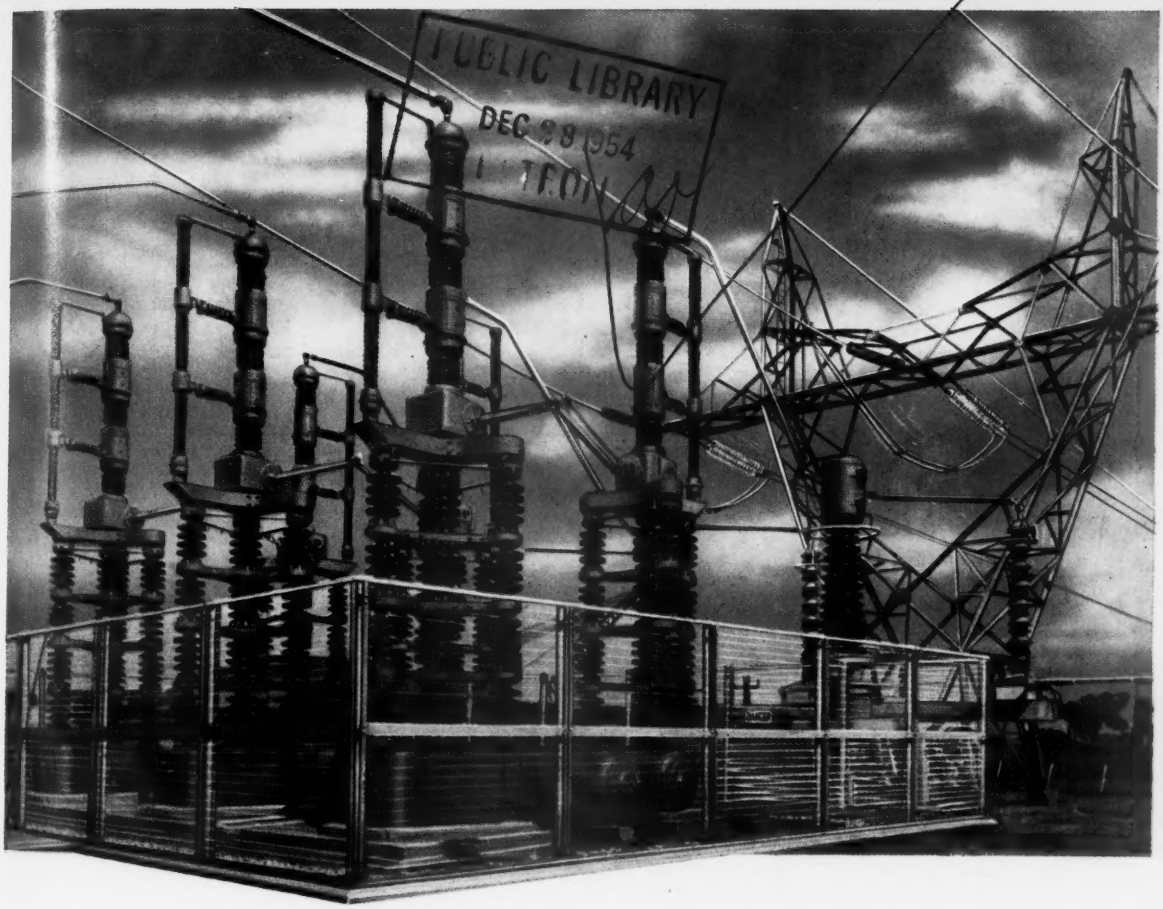
# ELECTRICAL REVIEW

PUBLIC LIBRARY
DEC 28 1954



An 'ENGLISH ELECTRIC' 275/300 kV 7500 MVA air-blast circuit-breaker in service at West Melton, controlling the first section of the British Electricity Authority's 275/300 kV system, namely the line to Staythorpe. This equipment has been in continuous service for nearly 18 months.

## 'ENGLISH ELECTRIC'
## switchgear

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

*Switchgear Department, Stafford*

55.15K4

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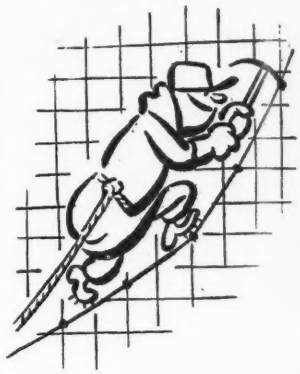
S210-129

# THE R.E.A.L. PLINTH LIGHT

*Pat. No. 659,876*

At the time that this announcement was put to bed, our Accredited Wholesalers (in practically every part of the Country) were in a position to give "off the shelf" delivery.

BUT this Season's Plinth Sales Graph looks something like a visual of another Everest Expedition.



The Christmas rush has started. May we suggest that you 'phone your Wholesaler immediately, and avoid the possibility of being "tailed off."

***In case of difficulty, we will do our best to fill your requirements, but local purchase will avoid Carriage Charges, and the inevitable transit delay.***

*Issued by :*

**ROWLANDS ELECTRICAL ACCESSORIES LTD.**

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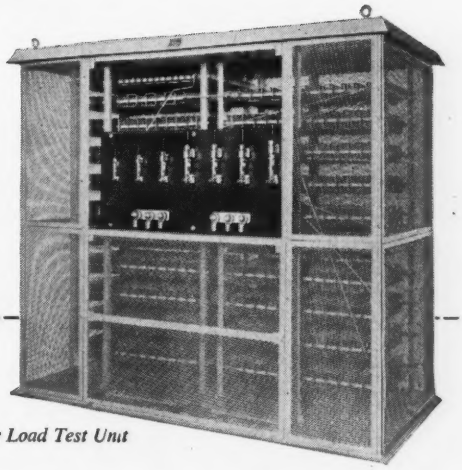
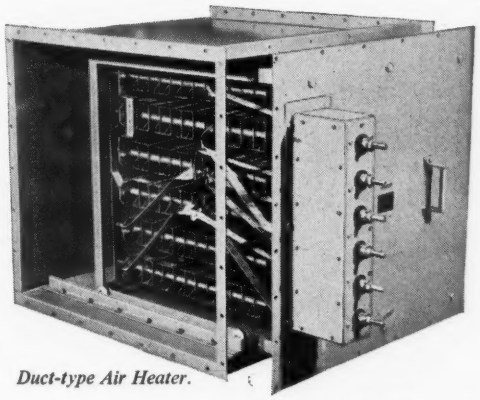
# RESISTORS AND HEATERS

"EXPAMET" Resistors and Heaters of many types for varied applications are manufactured by the Electrical Department of the Expanded Metal Company Ltd. Write for illustrated brochures or ask an Engineer to call and discuss your requirements.



*Generator Load Test Unit*



*Duct-type Air Heater.*

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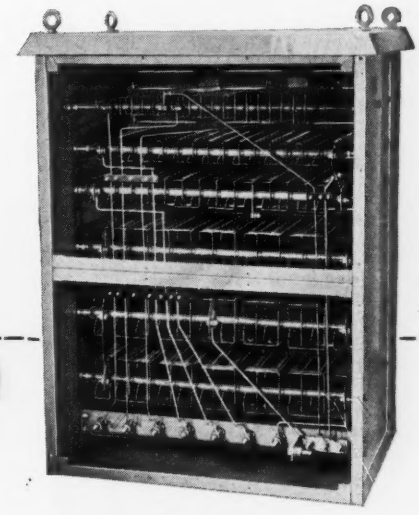
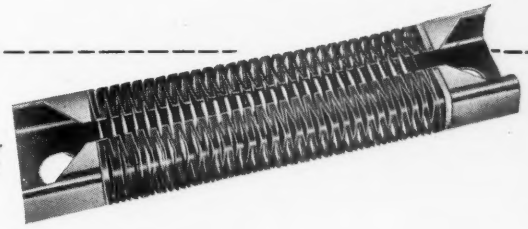


*Industrial Starting Resistor*



*Typical Girder Type Element*

Expamet

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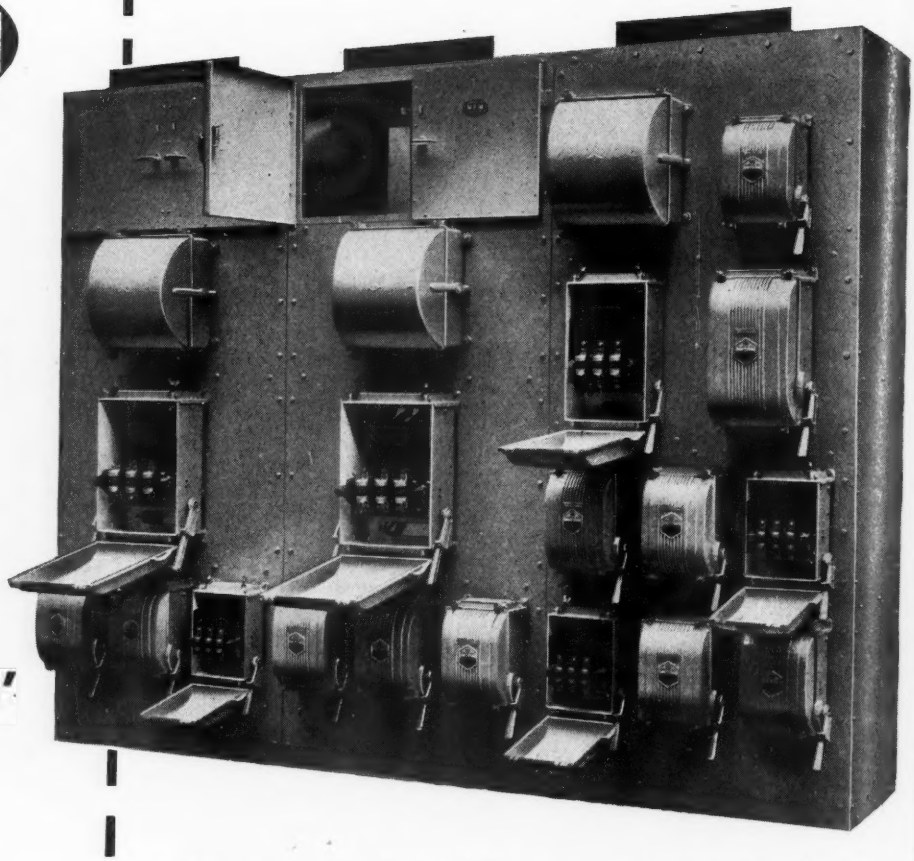

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BENEFIT from the bigger and better 'Custom-Built' department at MEM. It means a better switchboard at lower cost and quicker delivery into the bargain. MEM specialist engineers will advise on design—their help can often save money as well as space. And the switchboard will include standard MEM switch and fuse gear outstanding for its reliability and easy maintenance.

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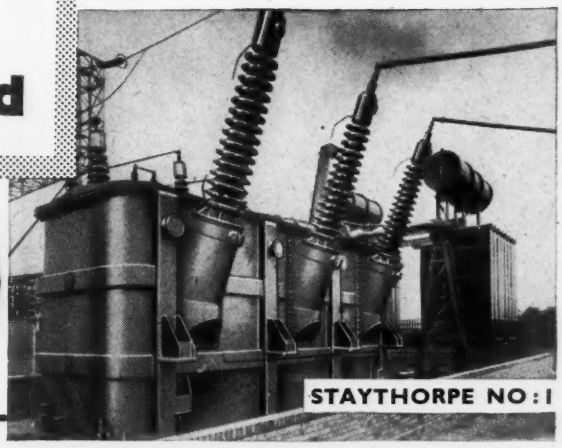
# 120 MVA TRANSFORMERS

for the

# 275 kV British Supergrid

The first of ten BTH transformers for the BEA supergrid was transported to site early in 1953, and was officially commissioned in July of that year.

**IN SERVICE**

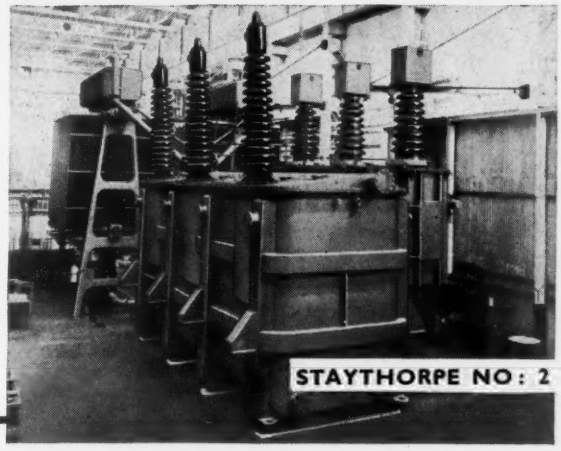


STAYTHORPE NO: 1

**READY FOR SERVICE**

*This transformer is now on site, having passed satisfactorily all specified tests including :—*

Heat run at full-load losses.
Induced voltage tests at 460 kV to earth and 550 kV between phases.
Impulse tests on 275 kV windings at 1050 kV.
Impulse tests on 132 kV windings at 550 kV.



STAYTHORPE NO: 2

The two transformers for West Melton Substation are now under construction at Rugby. No. 1 has its core and windings assembled, while the core of No. 2 has been laid down.

**IN PRODUCTION**

WEST MELTON NO: 1

WEST MELTON NO: 2

B T-H

## BRITISH THOMSON-HOUSTON

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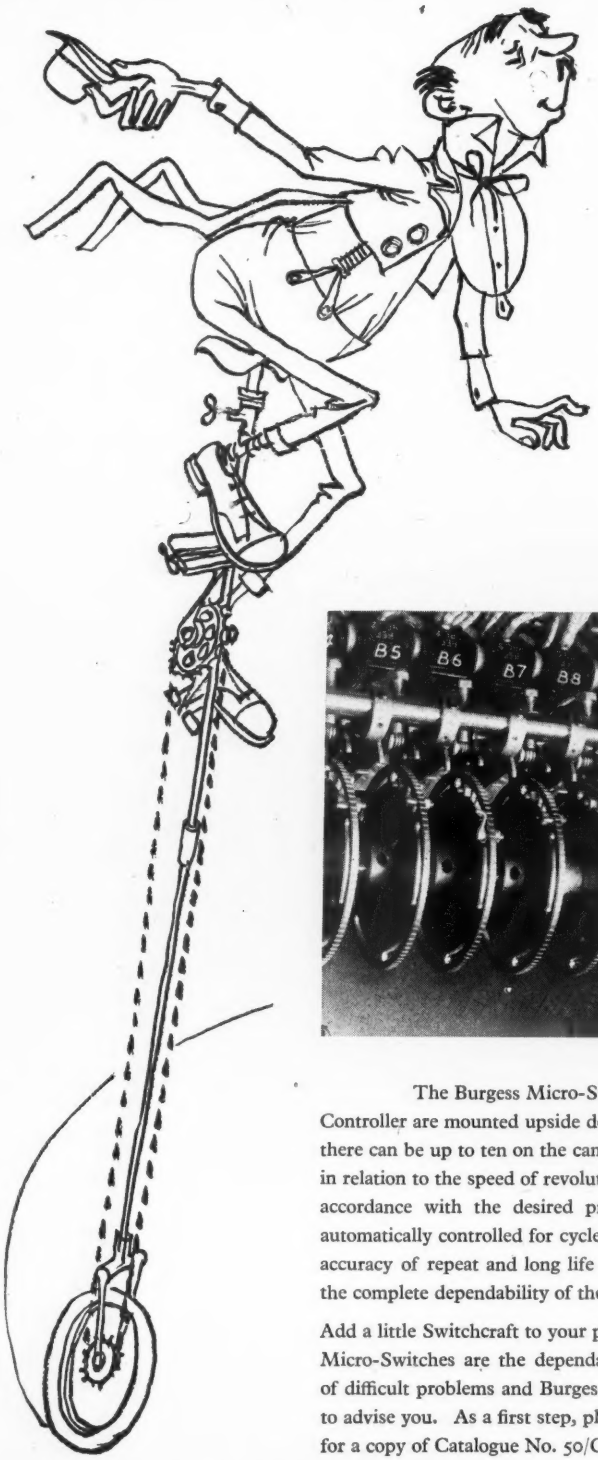
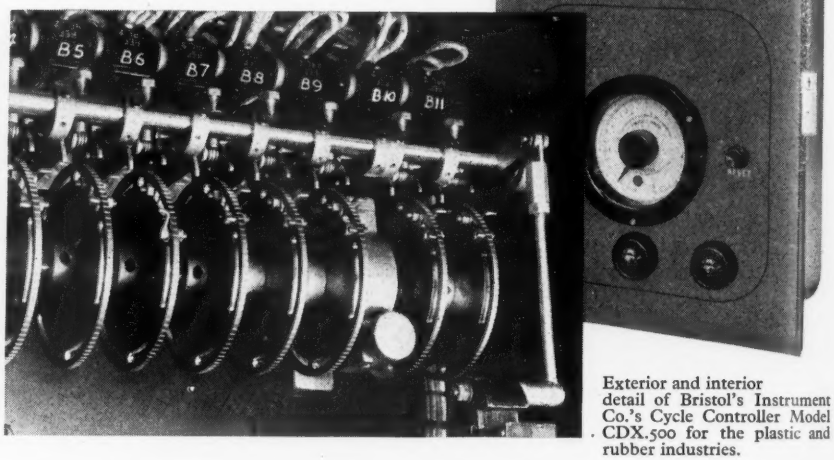


# Add a little SWITCHCRAFT to Cycle Controlling

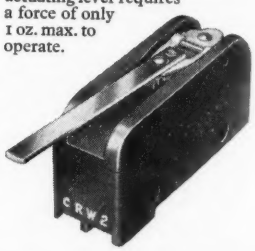



Exterior and interior detail of Bristol's Instrument Co.'s Cycle Controller Model CDX.500 for the plastic and rubber industries.

The Burgess Micro-Switches seen in the above photograph of Bristol's Cycle Controller are mounted upside down and are operated by dogs locked to cams of which there can be up to ten on the camshaft. The actuating devices are most carefully timed in relation to the speed of revolution of the camshaft to operate each switch precisely in accordance with the desired programme. In this manner up to ten processes are automatically controlled for cycle durations ranging from 20 seconds to 5 minutes. The accuracy of repeat and long life of the Burgess Micro-Switches are factors upon which the complete dependability of the instrument relies.

Add a little Switchcraft to your products too — Burgess Micro-Switches are the dependable answer to all sorts of difficult problems and Burgess engineers are waiting to advise you. As a first step, please write or telephone for a copy of Catalogue No. 50/C.

**Type CRW2.** The type of Burgess Micro-Switch employed in this application is a standard model available from stock. The strong actuating lever requires a force of only 1 oz. max. to operate.

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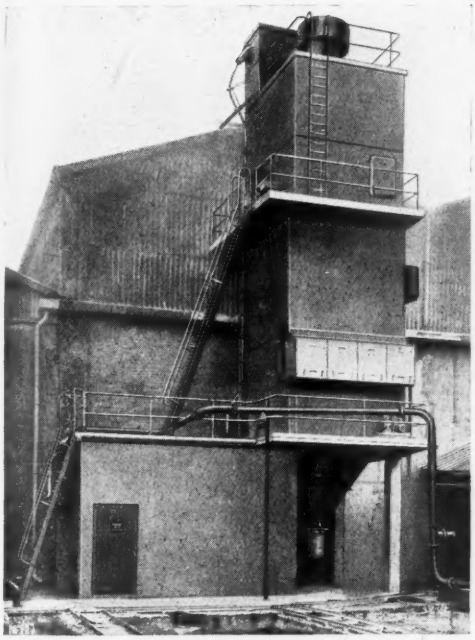
**loss of valuable material in flue gases—production of dust or mist liable to damage other portions of your plant —a nuisance caused by the emission of dust or mist—the need for a completely dust-free atmosphere in certain rooms—the elimination of bacteria from an air supply ?**

*then you need*

# STURTEVANT

## ELECTROSTATIC PRECIPITATION



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INVESTIGATE SUCH PROBLEMS

PUBLICATION U.7007
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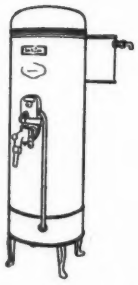
STURTEVANT PRECIPITATORS
AVAILABLE ON REQUEST

*The Sturtevant Electrostatic Precipitator on the left is collecting Asbestos Cement Dust*

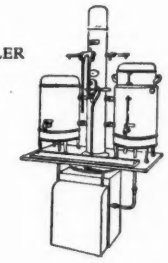
**STURTEVANT ENGINEERING CO. LTD.**

**Southern House · Cannon Street · London · E.C.4**

# 'What matters most in a boiler . . . . .



'JACKSON' BOILER



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a service of unfailing regularity—
whatever the pressure of work ;
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And that is just how the
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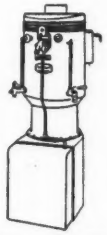
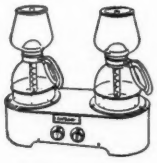
*on the thing that matters most*—
a regular and unfailing supply of
fresh and positively boiling water.



'TEATOMATON' FOR FACTORY CATERING



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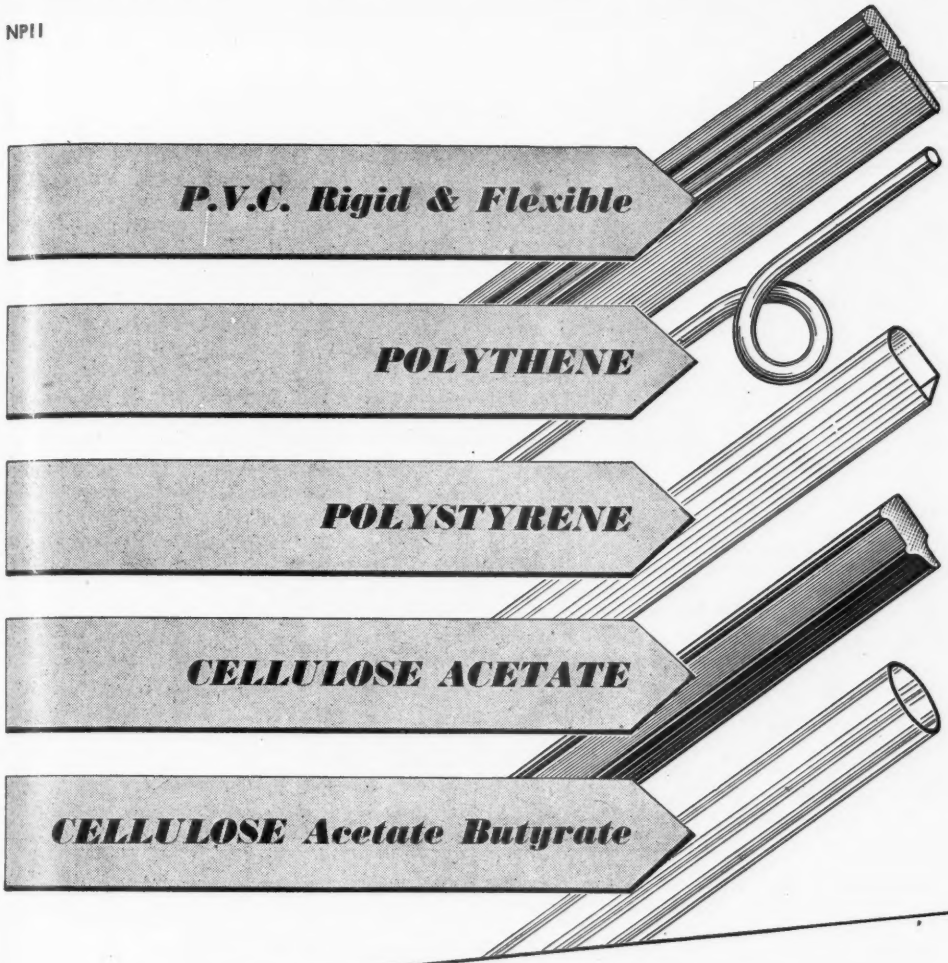


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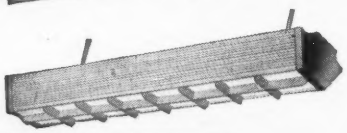

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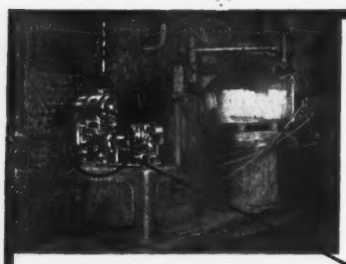

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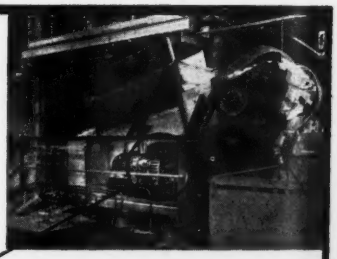

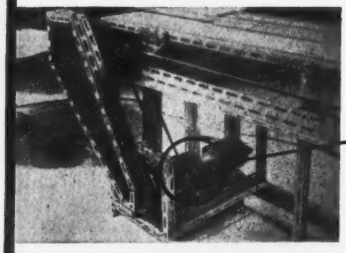

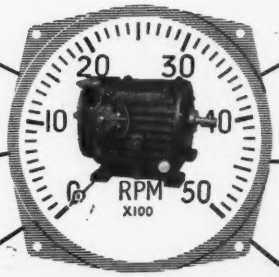

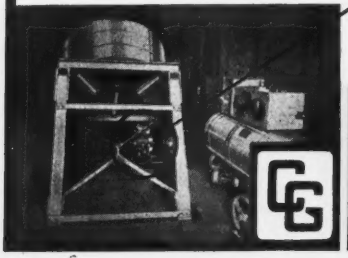

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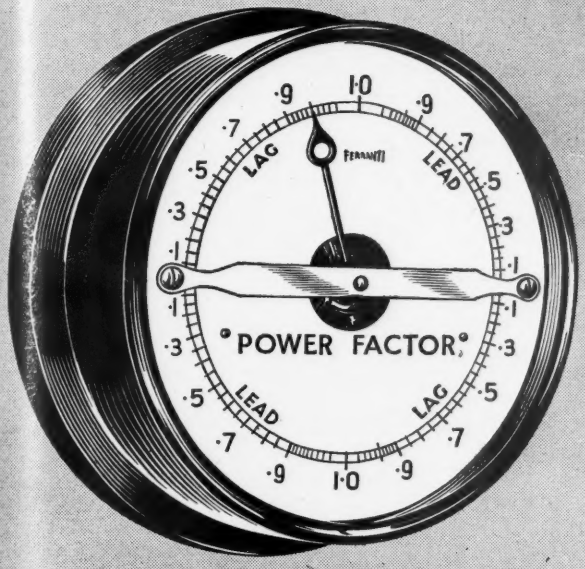
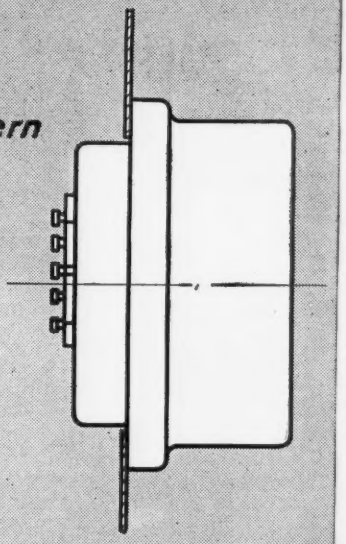



*Round Pattern*



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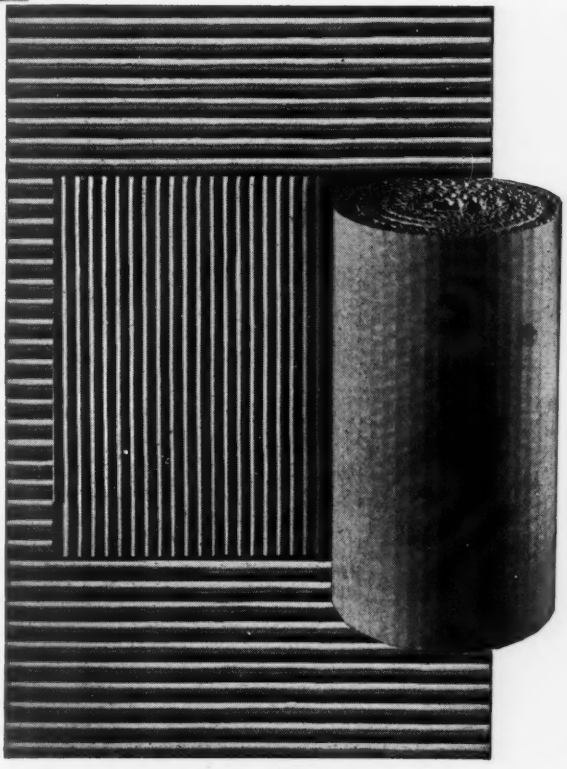
**THAT WAY**



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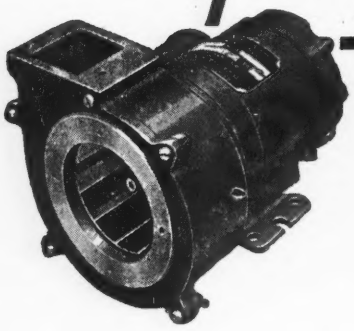
# SECOMAK
Regd.



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for high velocity
**SUCTION** and
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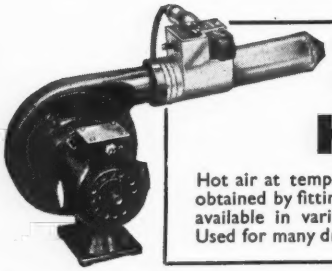
- Compact and light, will run in any desired position
- Extremely adaptable and highly economical
- Static pressures up to 33" w.g., air volumes up to 140 c.f.m.



*ALSO . . .*
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## HOT AIR
Hot air at temperatures up to 700°F can be obtained by fitting "Secomak" Heater Units, available in various sizes to fit all models. Used for many drying and heating operations.

*For full information and details of other 'Statair' units write for Data Sheet 104/37E*

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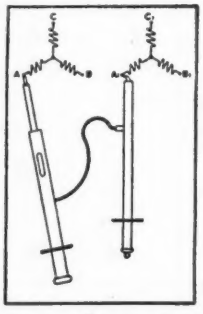

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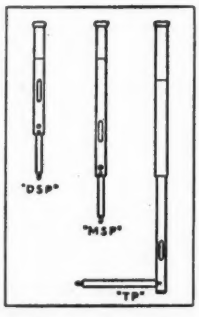


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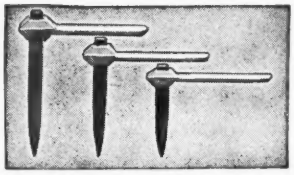

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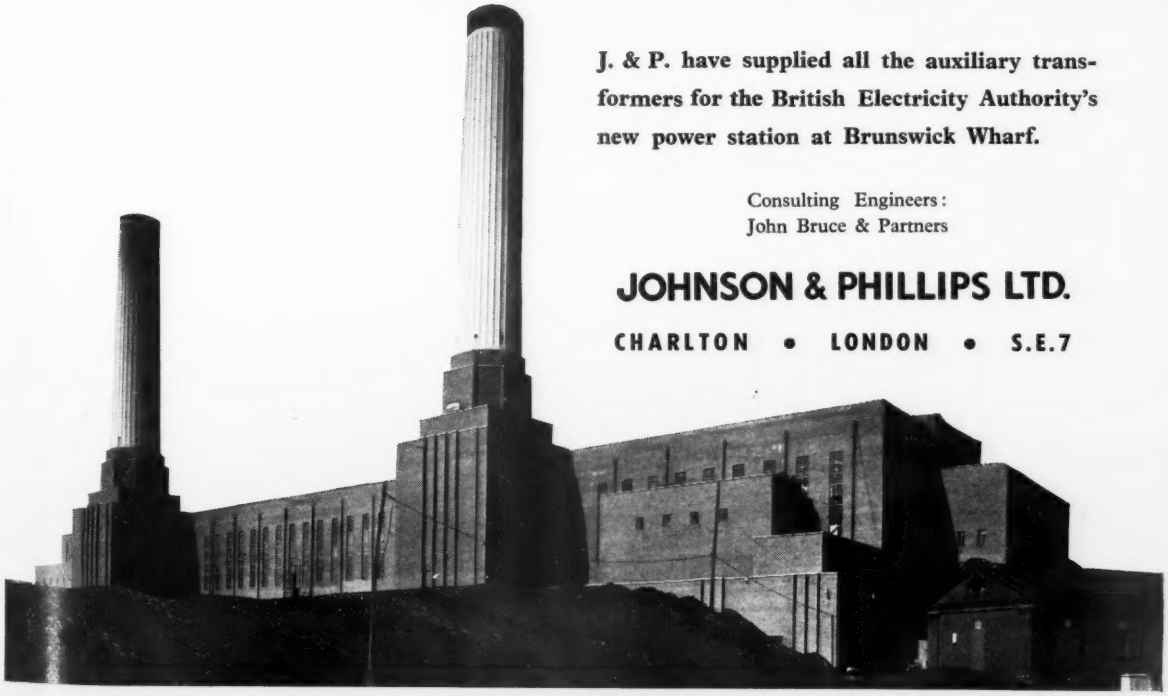
# . . . 27 J. & P. TRANSFORMERS

## for Brunswick Wharf Power Station



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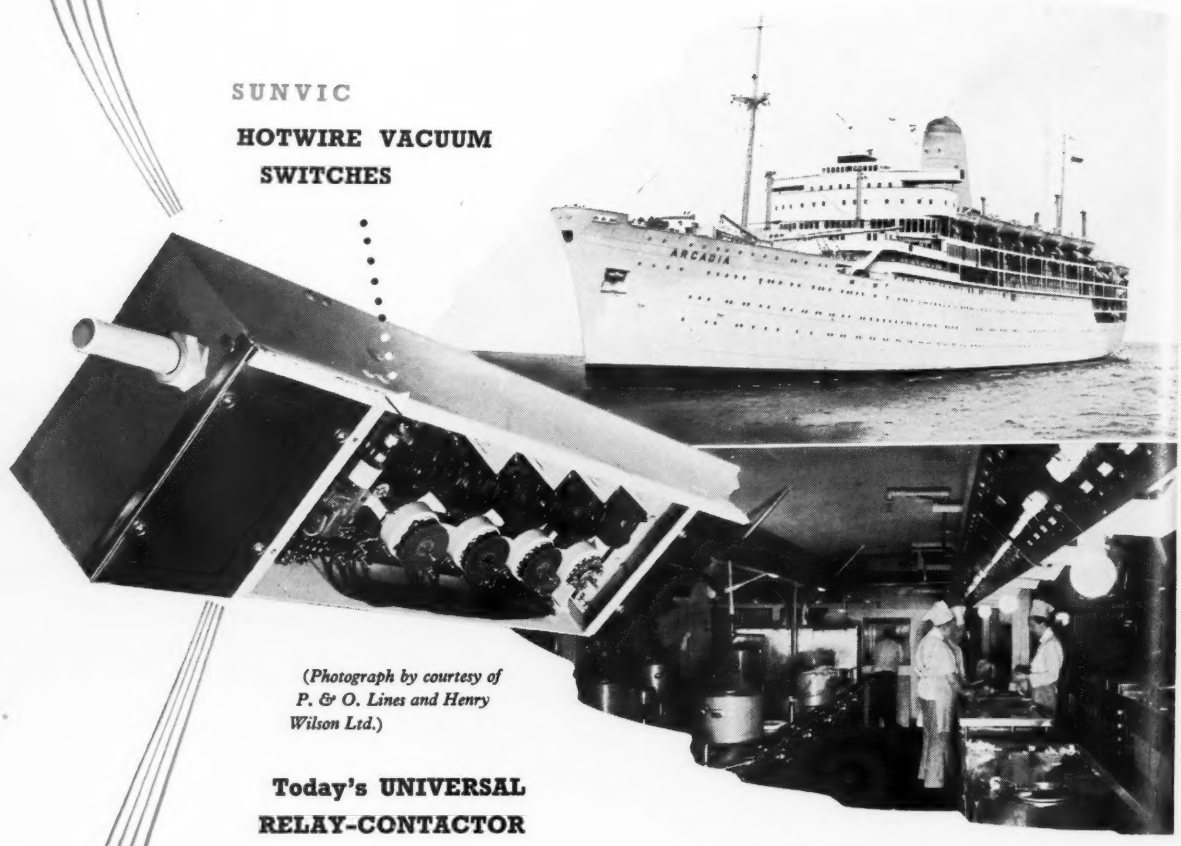


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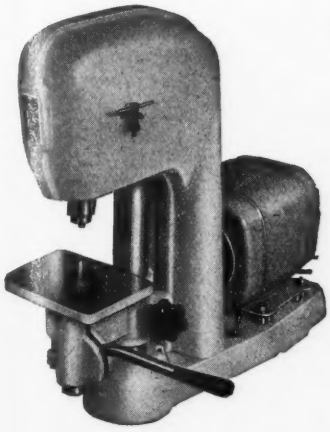

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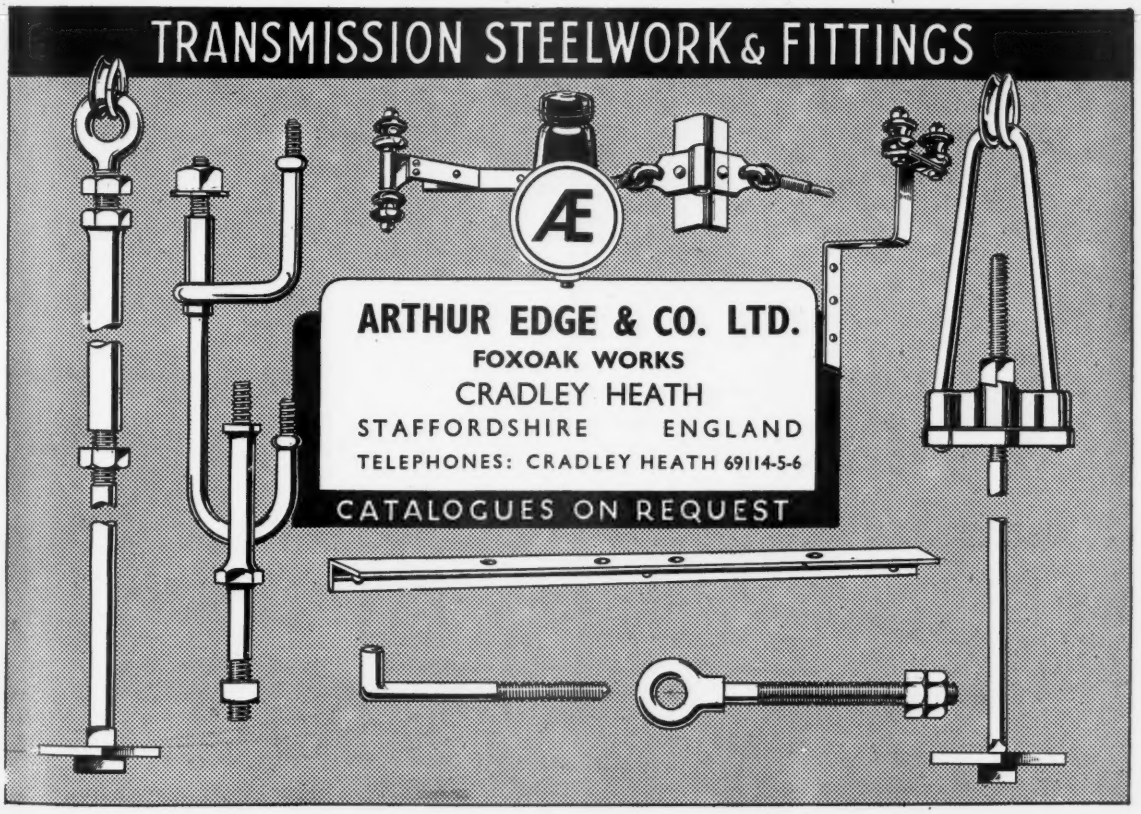

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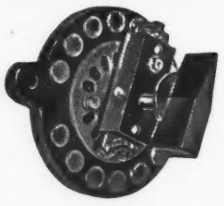

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15 amp. – 30 amp.
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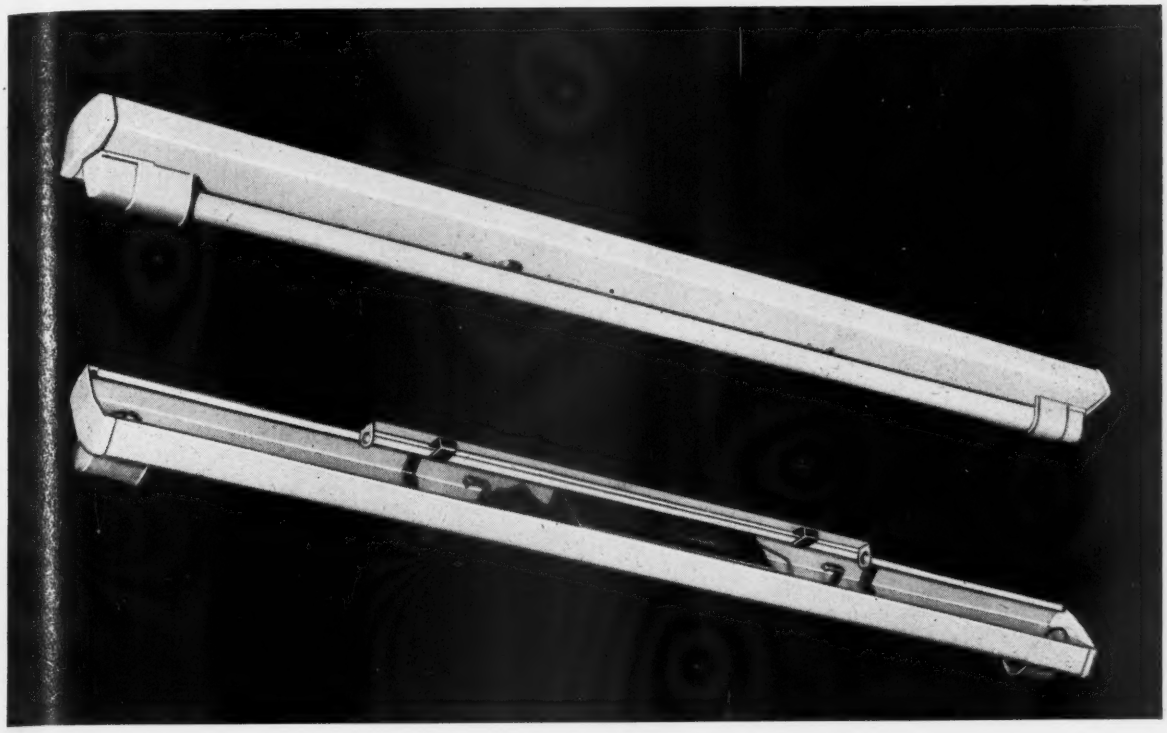

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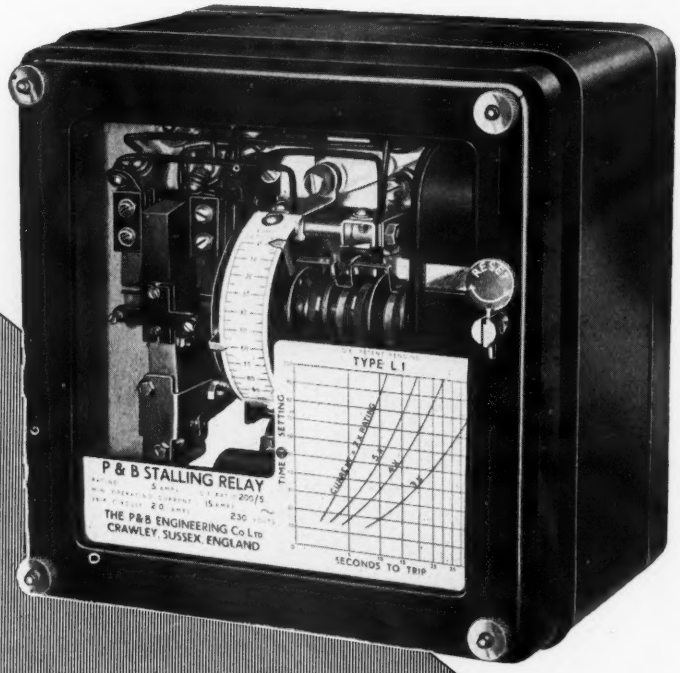


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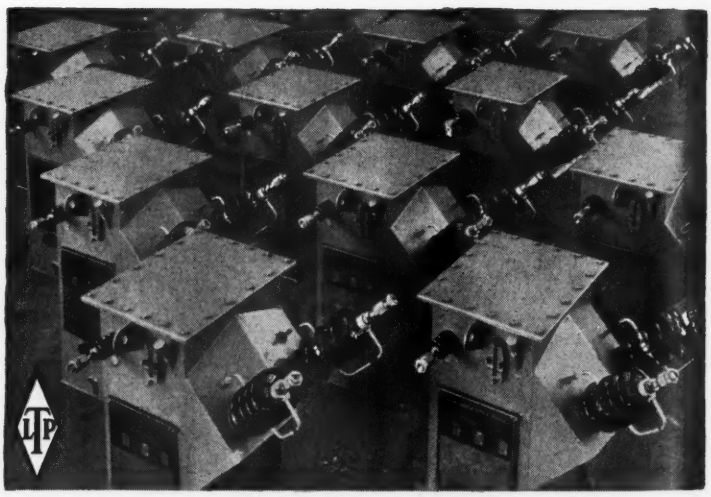

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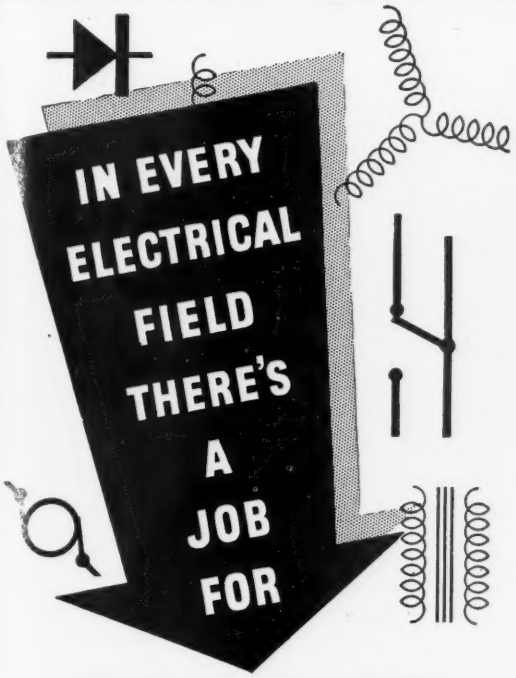


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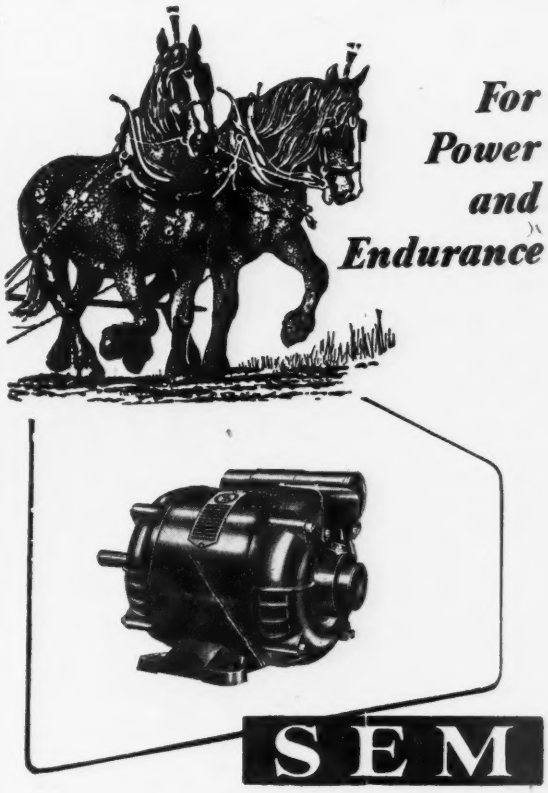


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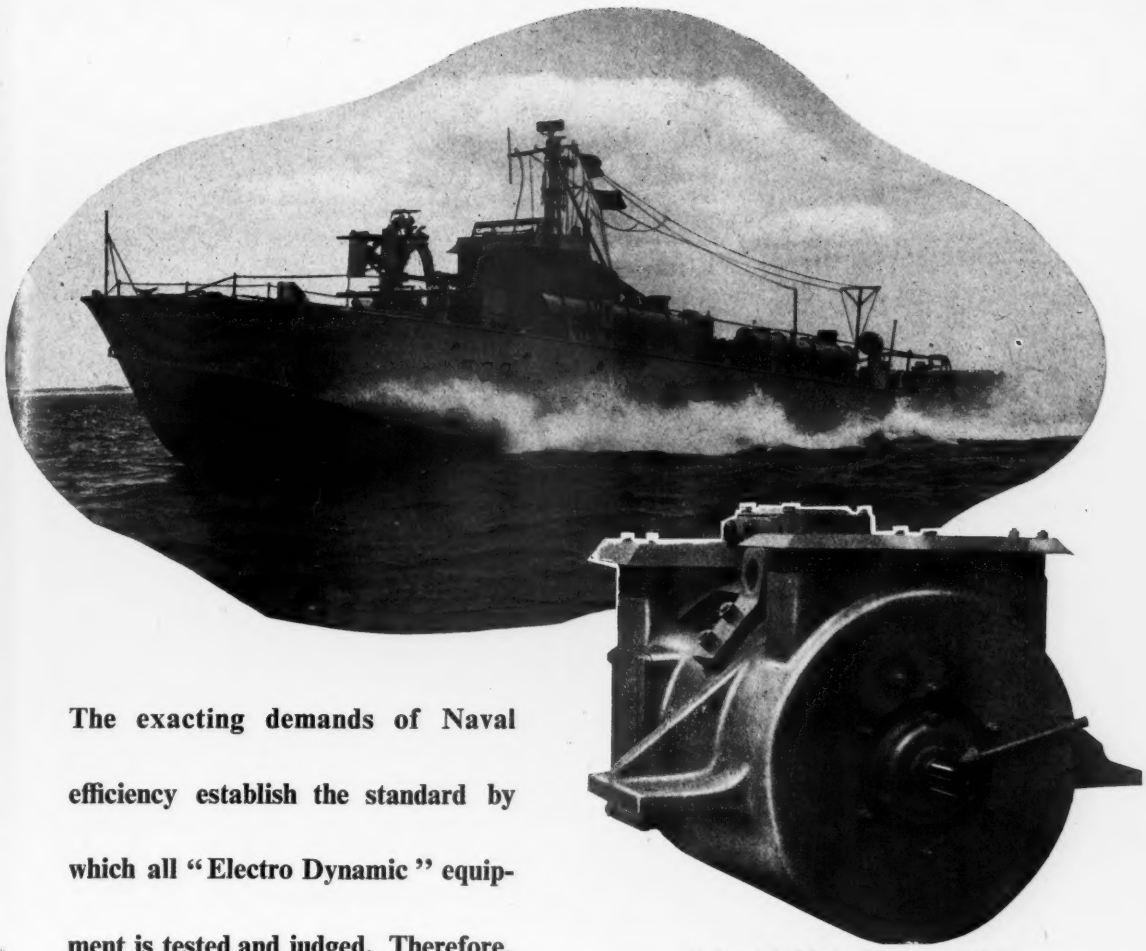

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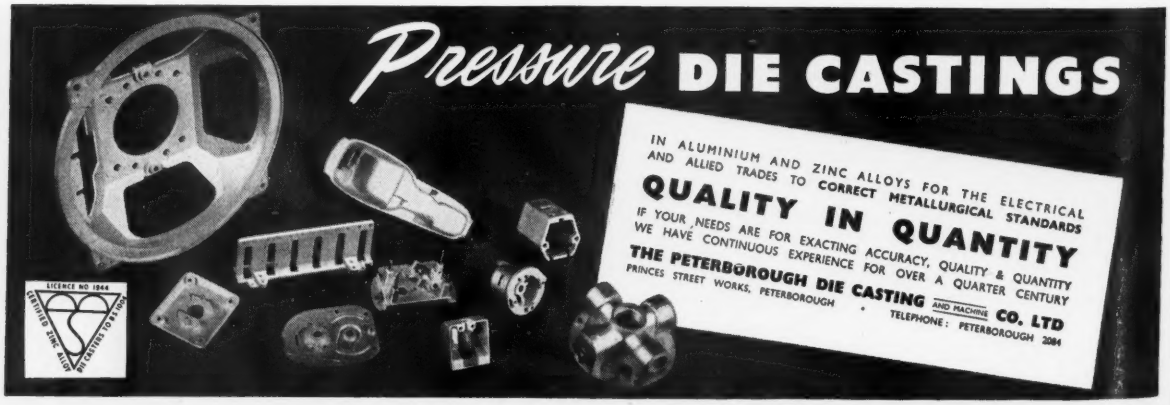
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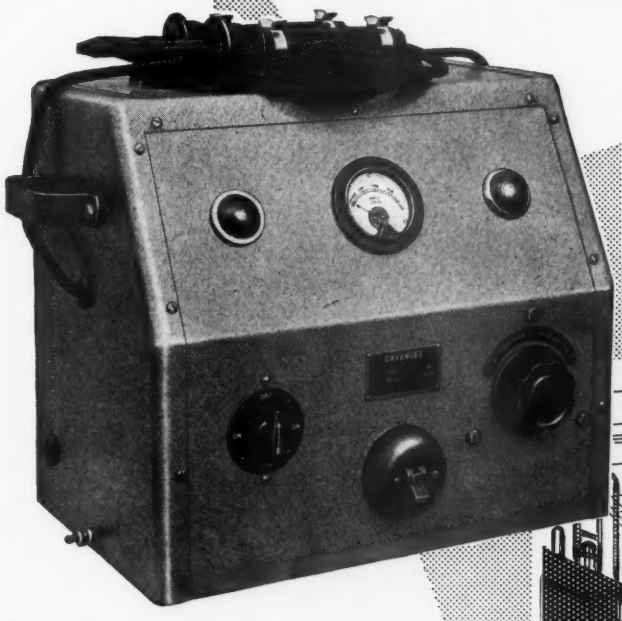

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**WEIGHT.** 34 lbs.

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The test voltage is applied smoothly without high stress from voltage surges.

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A miniature magnet circuit breaker in the primary circuit and double pole on-off switch with double pole mains fuses provide perfect protection.

**VOLTMETER.**
A high grade instrument connection in the primary circuit but scaled to read output voltage.

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Amber indicates when mains switch is turned ON. Red indicates when high voltage control is raised from zero.

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Heavily insulated and shrouded spring loaded test prods protect the operator. The transformer is double wound and fitted with a copper screen between windings. A substantial earthing terminal is provided to which the chassis, cubicle and meter-winding screen are efficiently grounded.

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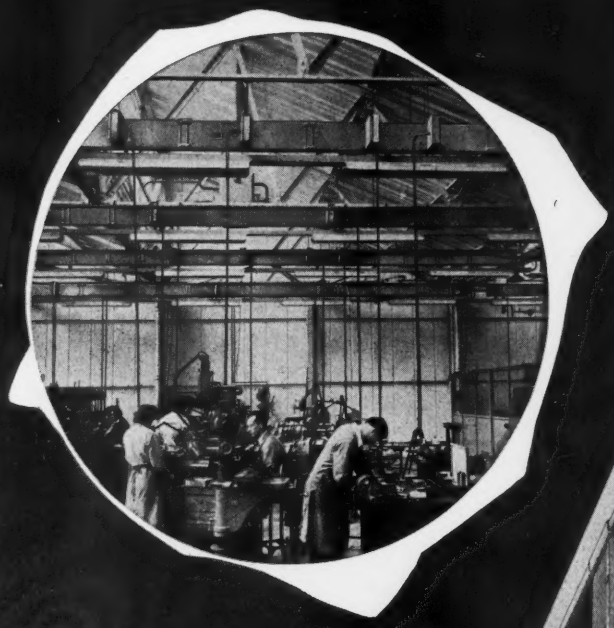
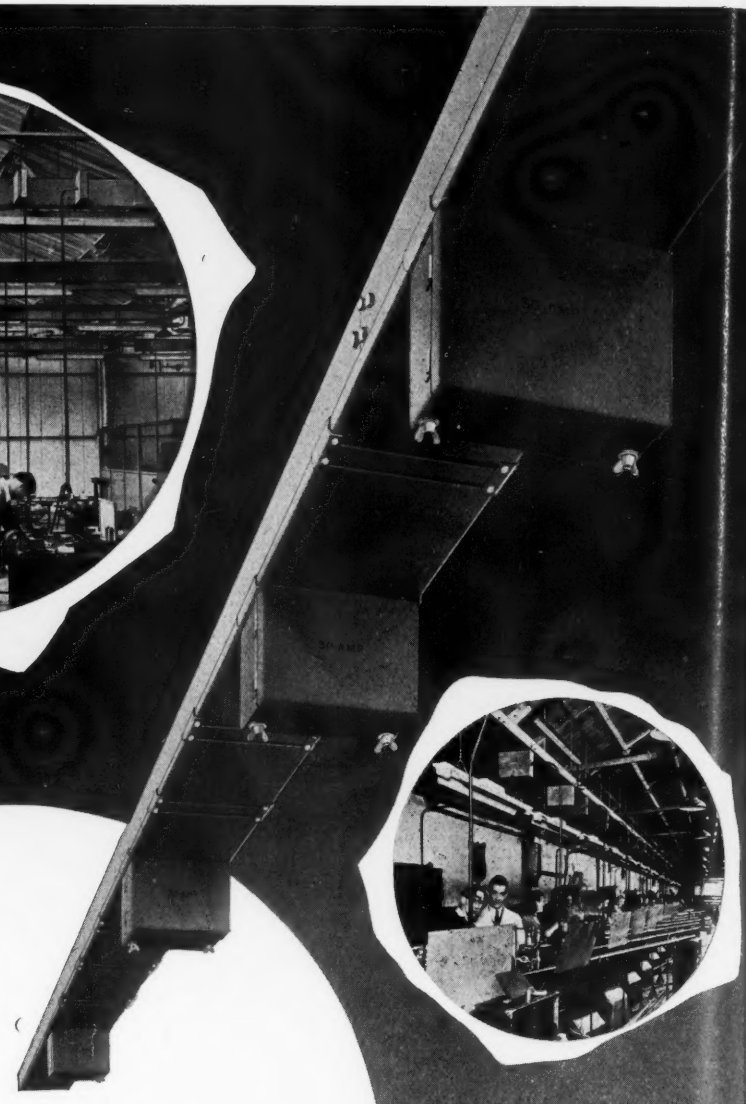
## 2·5 kV at 500 VA INSULATION TEST SET

**PRICE £38 . 10 . 0**
complete with Test Prods.

**PARTRIDGE WILSON & CO. LTD., Davenset Electrical Works, Leicester**







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**busbar trunking**

Economical to install and easy to re-arrange or extend without interrupting the electric power supply, Busbar Trunking will increase the operational efficiency and improve the safety margins of any factory.

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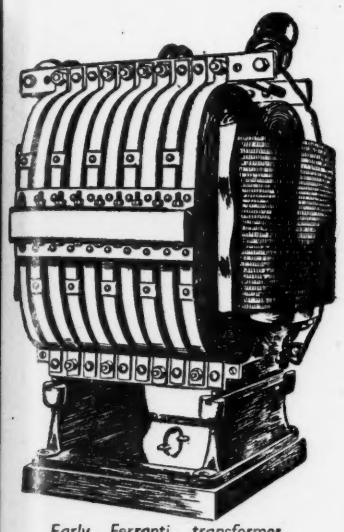
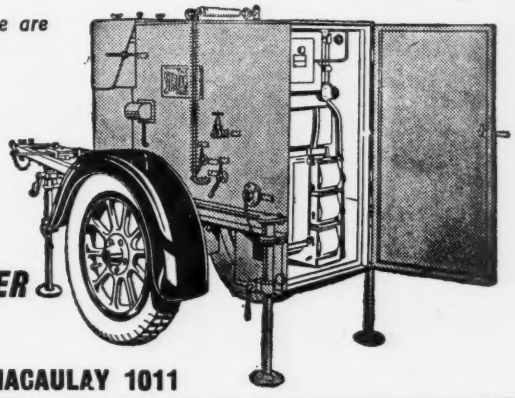


Early Ferranti transformer built in 1891 now in the Science Museum, S. Kensington

# The first Transformers created a problem . . .

*Oil-immersed Transformers and Switchgear were essential to the advance of electricity by permitting heavier loads to be carried by smaller conductors, but for their efficient operation the oil must be maintained at the highest standard of purity, dryness and insulating capacity. For the past 30 years Stream-line Filters have ensured the safety and efficiency of transformers and switchgear in 62 countries of the world. There are over 40,000 satisfied users.*



**Stream-line**

**FILTERS PROVIDE THE ANSWER**

**STREAM-LINE FILTERS LTD.**

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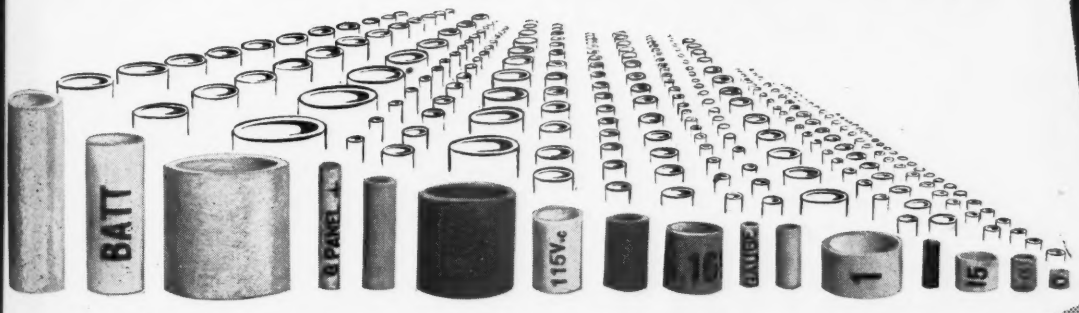
**Tallest on the right, shortest on the left- FALL IN!**



EVERY Hellermann sleeve is a soldier in the war against faulty insulation and muddled circuitry. And an easily deployed soldier at that. Used with the Hellermann Binding Tool these sleeves bind, insulate and identify in one quick operation. There is a large standard range of Hellermann sleeves in a wide variety of colours, and these can be printed to your own requirement. They are supplied to the requirements of specification DEF 20. List No. BH29 available on request.

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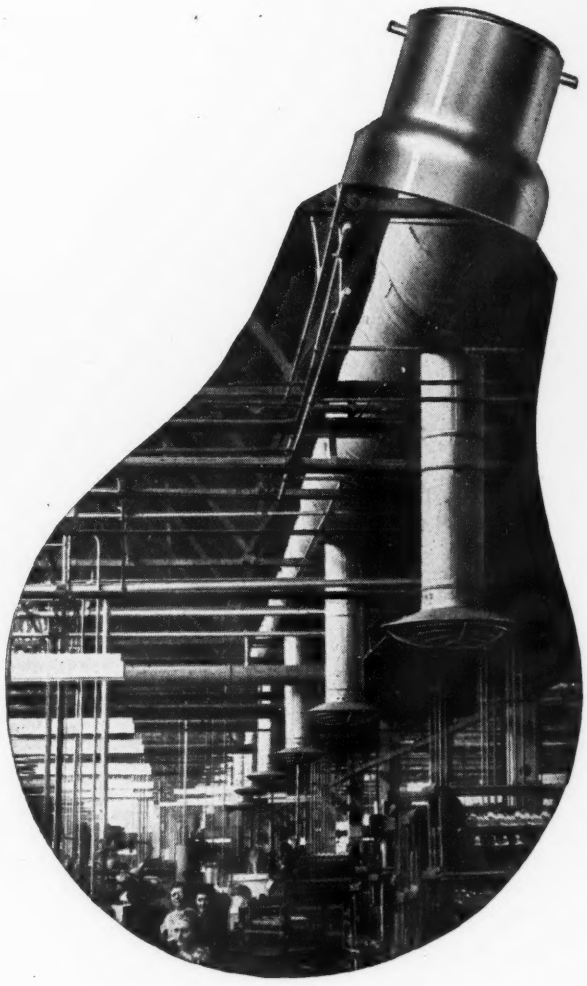
This immense plant consists of several Pumping Stations, each operated by 25 h.p. motors which deliver heat-treated, purified air via distributor ducts throughout the entire factory. Each Pumping Station circulates no less than 159,000 cubic feet (5½ tons) of air per minute ! The temperature of the circulated air is precisely stabilised by thermostatic control.

*This is another example of the strict control and technical care insisted upon at every stage in the manufacture of Royal "Ediswan" Lamps.* Nothing is left to chance — *careful testing and checking of every lamp ensures that each conforms to the highest standard of requirement.*



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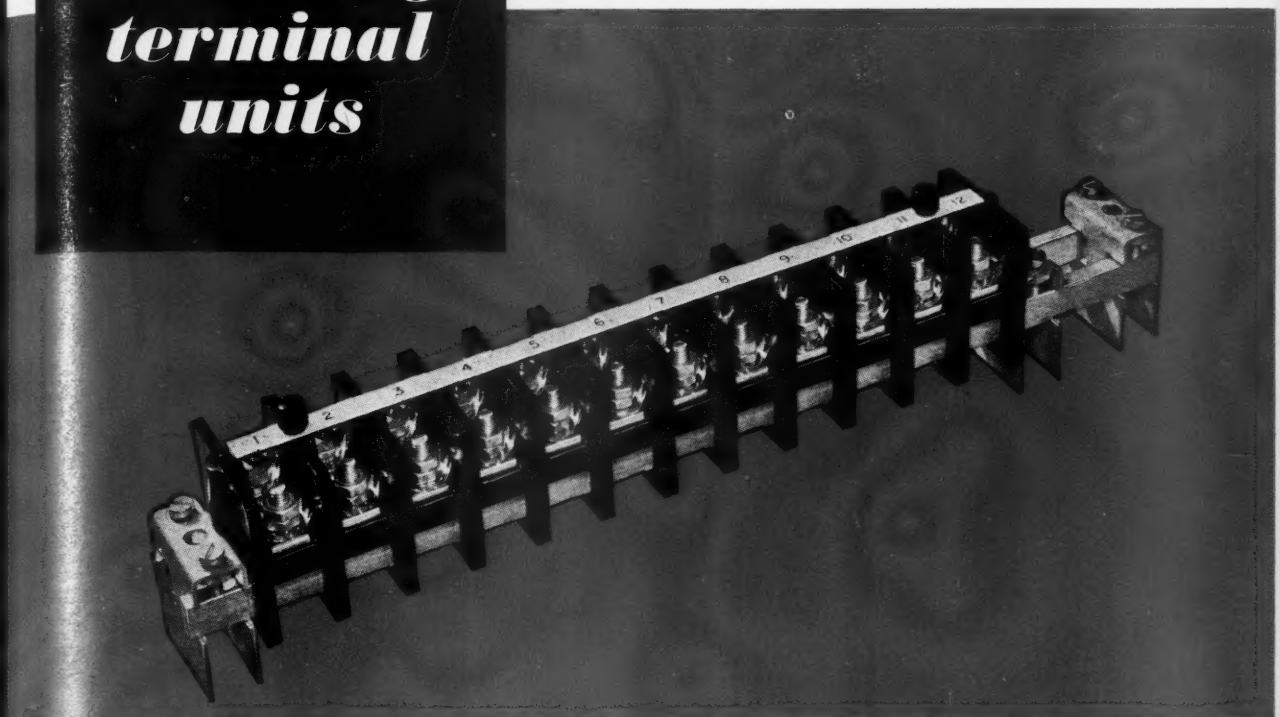
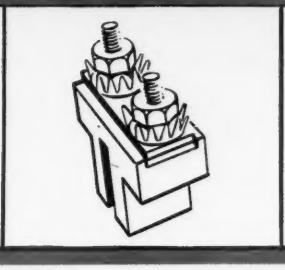
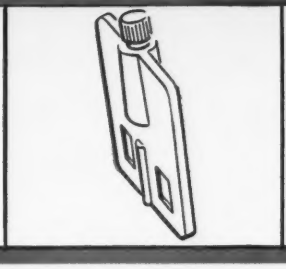
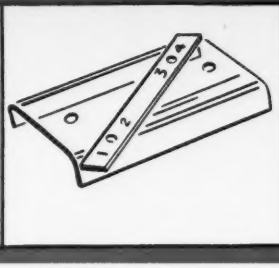
# ASTRAL *multiway terminal units*









***APPLICATIONS*** Cable terminations, interconnections and testing. L.T. systems, switchboards, control equipment, traction, etc.

***DESIGN*** Any number of terminal ways, built from eight basic types of interlocking components. No live metal underneath, and room to pass cables under. Framework earths. Optional, bridging links, two, three or more ways. Supplied assembled and complete, or in parts to order.

***MATERIALS*** Terminal pillars on solid plates, all nickelled brass, each pair on heavy moulded black phenolic segments, with separate barriers, all locking into position. Cadmium plated steel support bars, brackets and screws. Optional, nickelled copper bridging links.

***DIMENSIONS*** Overall height 3¼", width 2". Length, two-way 5 11/16" increasing 11/16" for each additional terminal way, example, twelve-way 14 13/16". Two 5/32" fixing holes at centres ½" less than overall length. Steel support bars ½" x ¼".

***TERMINALS*** Rating 60A. 660V. Each separate segment has two No. 0 B.A. Pillars, with lock nuts and claw terminals, or cable sockets if specified. Each interlocking segment can be separately removed, for easy connecting.

***SHIELD & LABEL*** Optional. Both separately detachable, secured by insulated screwed knobs. Rigid transparent P.V.C. shield. Ivorine label supplied blank, or numbered lettered per terminal way to order.

***INSTALLATION*** Units up to twenty-four ways, fixed with two No. 0 B.A. cadmium plated screws and nuts, supplied. Behind switchboards, on equipment panels, or mounted in Astral Adaptable or other boxes, cubicles, etc., as desired.

**Astral adaptable boxes too**

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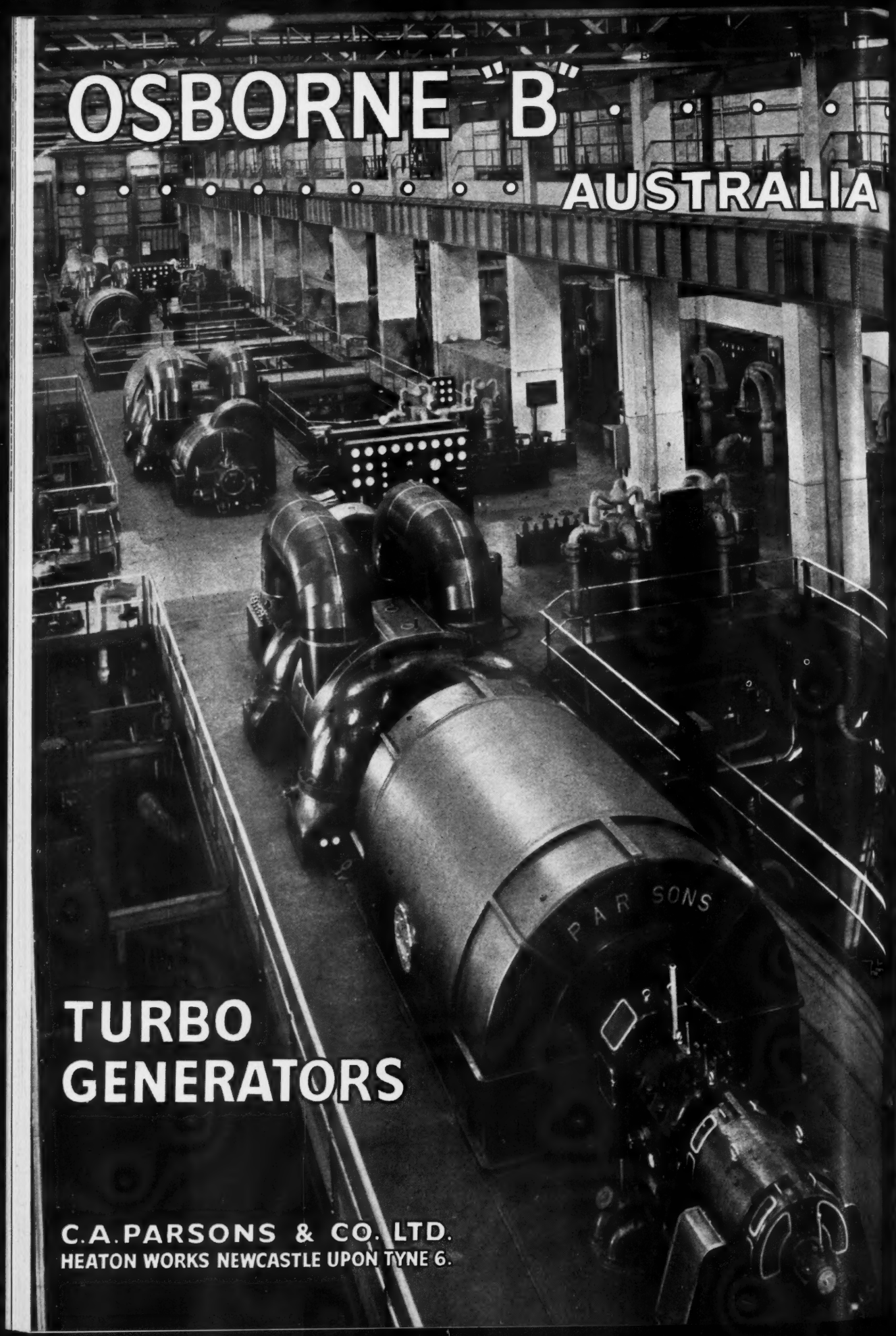


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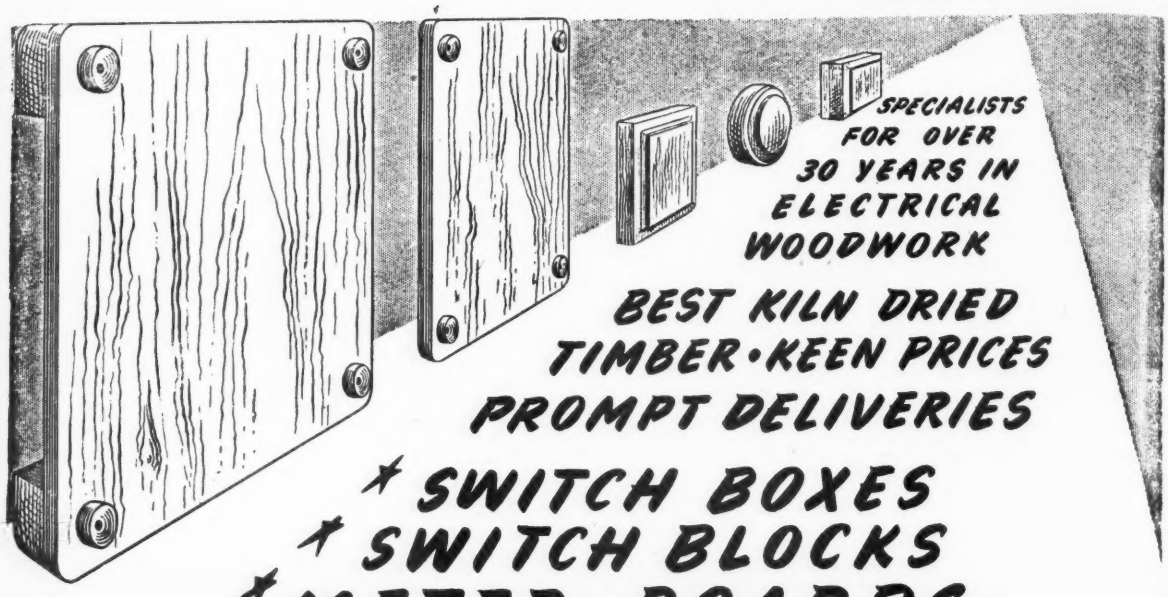


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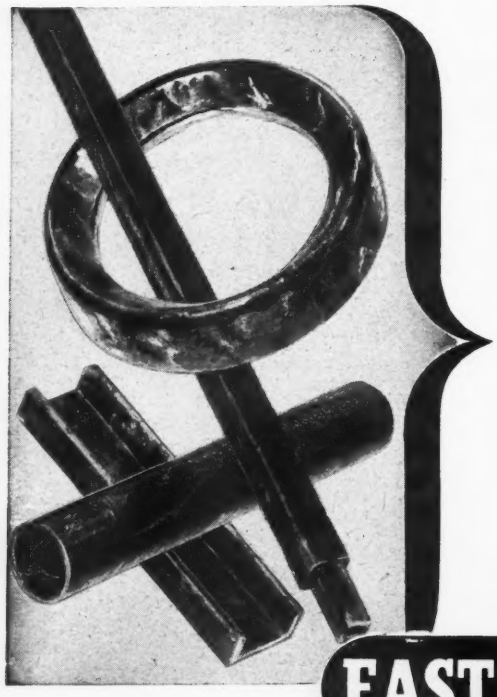

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# 260 feet a day...

A MOST INTERESTING history is attached to this extensive new store recently erected by Tate & Lyle Limited at their Plaistow Wharf.

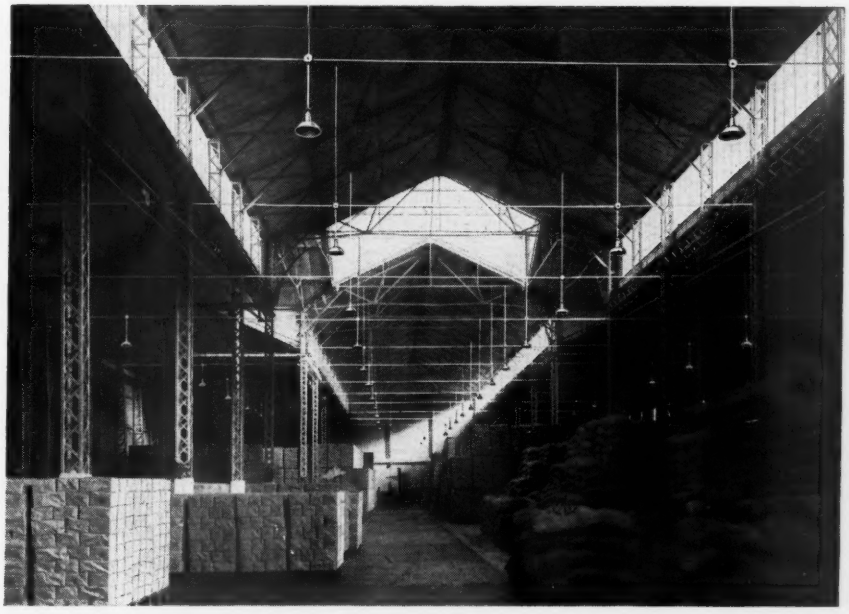
The original building was situated on the old White City Exhibition ground. All the steel work was dismantled, transferred to Plaistow, renovated, re-painted and re-erected, thus providing additional warehouse space in quick time and without the many problems of obtaining new materials.

Similar economies were achieved in the provision of a good all-round general illumination. From the nature of the structure it would have been a formidable and costly job to install conduit throughout the building, on account of the great height of the building and the consequent length of the droppers necessary to mount the light fittings.

By using ENFIELD GRID SUSPENSION SYSTEM the electrician concerned erected 260 feet a day, including 8 light fittings and 2 feed points. This was twice as fast as any type of conduit installation and represented a great economy in time and materials.

Moreover, the electrician and his mate had never before used Grid Suspension, but after their first experience they had no difficulty in installing more than 260 feet a day when they started on a second warehouse nearby.

*Another triumph for Mr. Cube and an Enfield product*



**ENFIELD CABLES LIMITED, VICTORIA HOUSE, SOUTHAMPTON ROW, LONDON, W.C.1**

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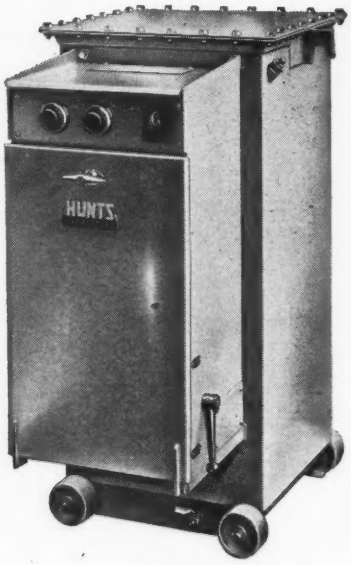
Is your factory equipped with Power Factor Improvement Capacitors? Are your executives aware of the financial saving made possible by reducing lagging current?

May we invite you to discuss with our technical staff *just how soon* the capital outlay can be recovered by the increase in electrical efficiency?

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*THE TRADE MARK OF RELIABILITY*

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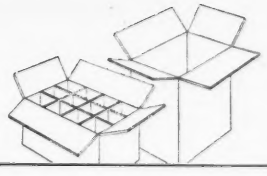

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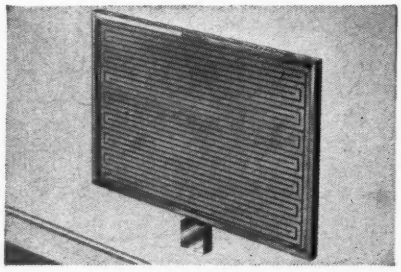
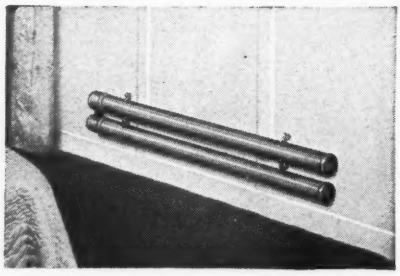
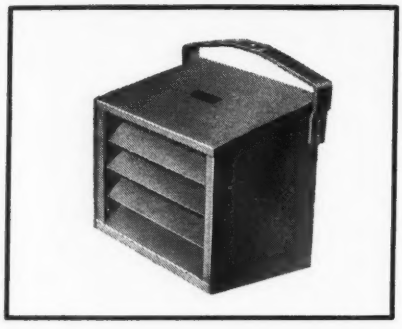


**'Radiant Glass' Thermopanels.** For non-luminous infra-red radiant warmth to any location requiring rapid local heating, in ½ and 1 kw. loadings in two types. Type RGF with wall frame, where appearance counts. Type RG (as illustrated) for industrial applications.



**Thermotubes.** Tubular heaters in lengths from 2 ft. to 12 ft. giving a great flexibility of installation. Horticultural, Waterproof and Flameproof types are also available.



**Unit Heaters.** Fan-type unit heaters for industrial application operated on forced air convection principle. A simple and unobtrusive method of providing medium to large volumes of heat for many locations. In 3 kw. to 18 kw. loadings.

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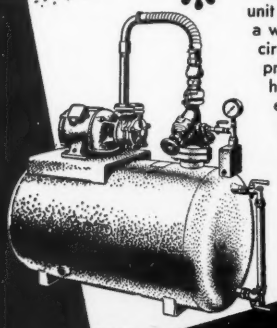

A compact, electrically operated unit to raise water from a well or borehole and circulate it at adequate pressure throughout the home, to farm buildings, etc. Inexpensive to operate, completely reliable and well worth remembering. May we send you descriptive leaflet PJ170 for your files?

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Power supply authorities in many countries have been impressed by the advantages of BICC Impregnated Pressure Cables for very high voltage transmission — advantages which have been amply proved by the 180 miles installed in England. The growing number of orders from overseas reflects the confidence of expert opinion in this type of cable.

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BICC design, manufacture and install power cables and accessories for all voltages up to 275 kV. Some of the I.P. cable contracts at present in hand are listed below.

**PORTUGAL**

Gas pressure type cables are to be employed for the first time on the 33 kV distribution system of Lisbon Electric Tramways Ltd. Previously solid type cables have been used. To meet load developments in Lisbon, BICC are to supply and install 7½ miles of 33 kV three-core I.P. cable.

**S. AFRICA**

The first I.P. cable in S. Africa will shortly be commissioned in Cape Town. Over 23 miles of 66 kV three-core cable have been supplied by British Insulated Cables (S.A.) Ltd., a member of the BICC group, to the Cape Western Undertaking of the Electricity Supply Commission of S. Africa. The cable will link the Salt River power station with two new sub-stations.

**AUSTRALIA**

The first I.P. cable including an underwater section is about to be commissioned in Sydney. The contract, for the State Electricity Commission of New South Wales, involved the supply and installation of 10 miles of 132 kV three-core cable — the first I.P. cable of that voltage in the Southern Hemisphere. BICC have subsequently received a contract from the Brisbane City Council for the supply and installation of over 31 miles of aluminium sheathed 33 kV three-core I.P. cable.

**S. AMERICA**

BICC have supervised the installation of the first I.P. cable in South America, in Porto Alegre, Brazil. Some 5½ miles of 69 kV three-core cable have been supplied to the Comissão Estadual de Energia Electrica, Rio Grande do Sul.

A number of films are available on loan to interested organisations, dealing with the manufacture, jointing and laying of underground cables. Please apply to nearest BICC Branch Office.

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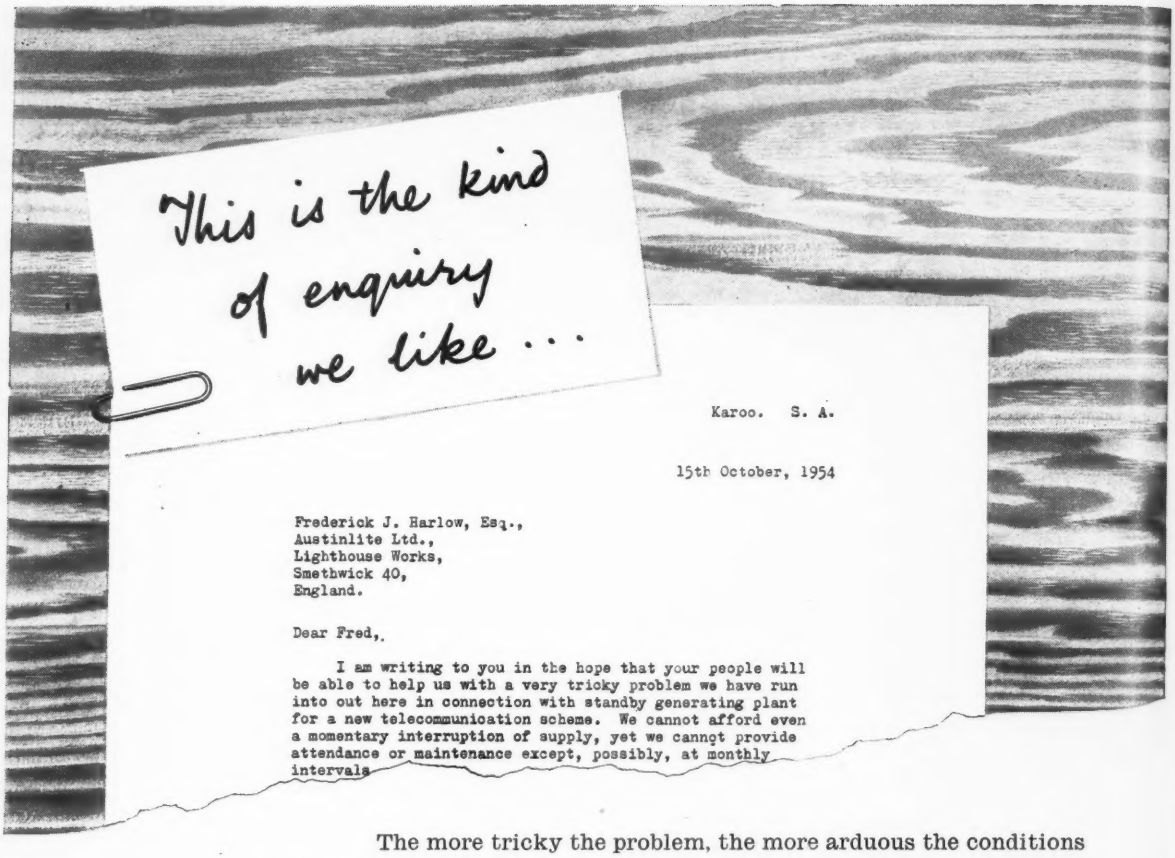
This is the kind of enquiry we like ...
Karoo. S. A.
15th October, 1954
Frederick J. Harlow, Esq.,
Austinlite Ltd.,
Lighthouse Works,
Smethwick 40,
England.
Dear Fred,
I am writing to you in the hope that your people will be able to help us with a very tricky problem we have run into out here in connection with standby generating plant for a new telecommunication scheme. We cannot afford even a momentary interruption of supply, yet we cannot provide attendance or maintenance except, possibly, at monthly intervals

The more tricky the problem, the more arduous the conditions under which the equipment must operate, the better we like it. Difficult, unusual generating plant is our metier. It does not matter how long it must run without attention. It does not matter whether there is a mains supply or not. Nor if the supply is erratic and unreliable. Even if the requirements do not come within our standard range Austinlite plant can be designed which will ensure continuous, steady and extremely reliable supply.

During the past 25 years Austinlite plant has been steadily developed, always with the emphasis on quality and dependability. We can now provide automatic generating plant of many types in sizes from 1.4 to 250kVA, for continuous unattended operation, or for mains standby work — to the strictest no break specification where necessary. However difficult a particular problem may be, we have good reason for the confidence with which we affirm that Austinlite can tackle it.

*In this country our plant is used by the G.P.O., the Ministry of Civil Aviation and British Railways. It is installed in many parts of the world in lighthouses where reliability is vital. It is in operation in South Africa, Australia, Denmark, the U.S.S.R., Malta, Syria, New Zealand and Norway; as well as a number of tropical countries including Nigeria, Malaya and Borneo.*

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*(The makers of Sumo Pumps and Stone-Chance Lighthouses)*

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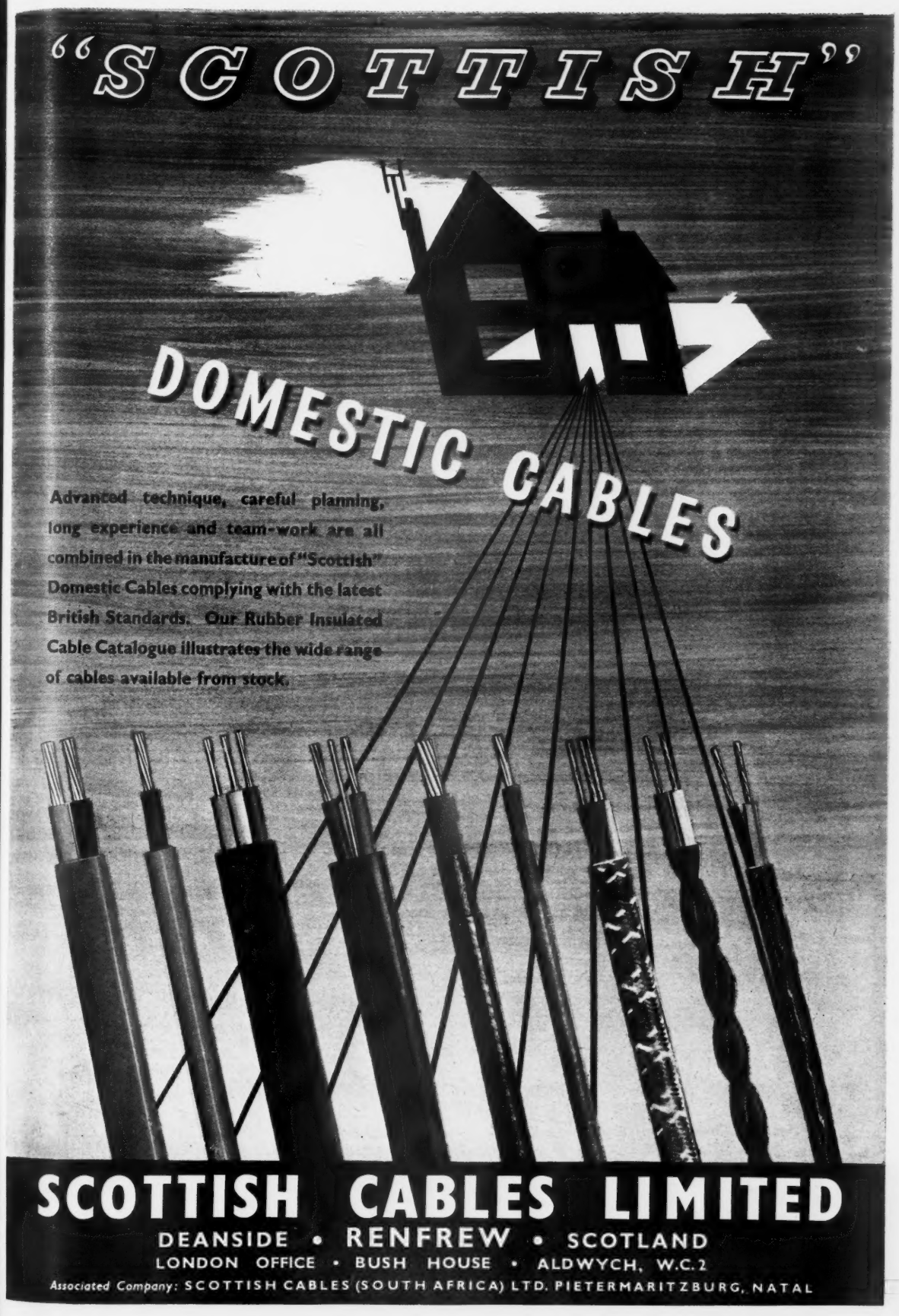
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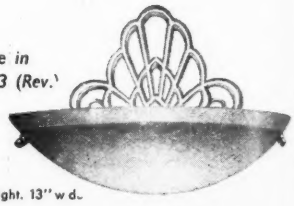

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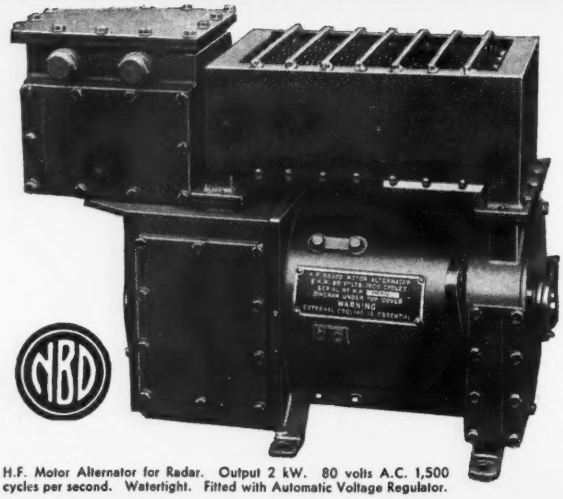

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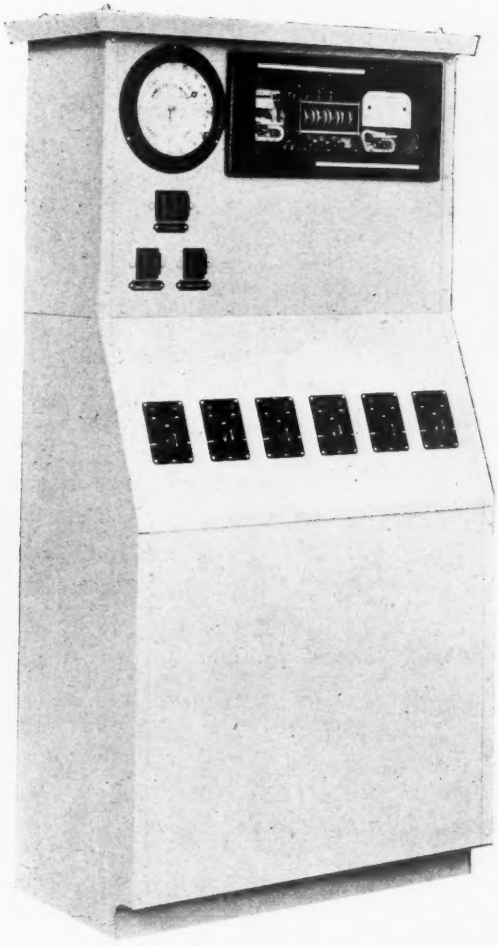

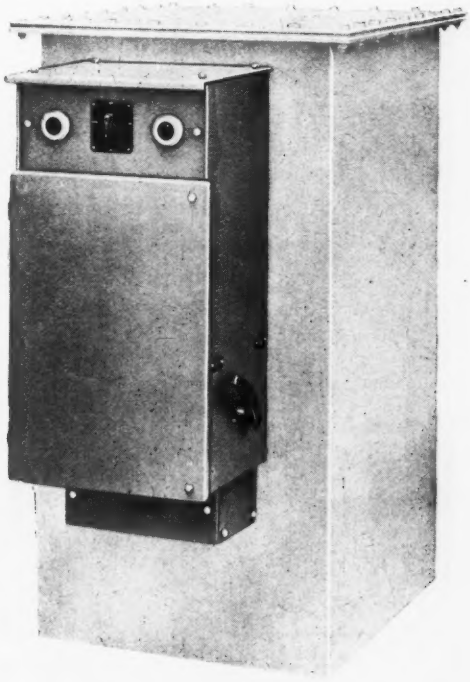

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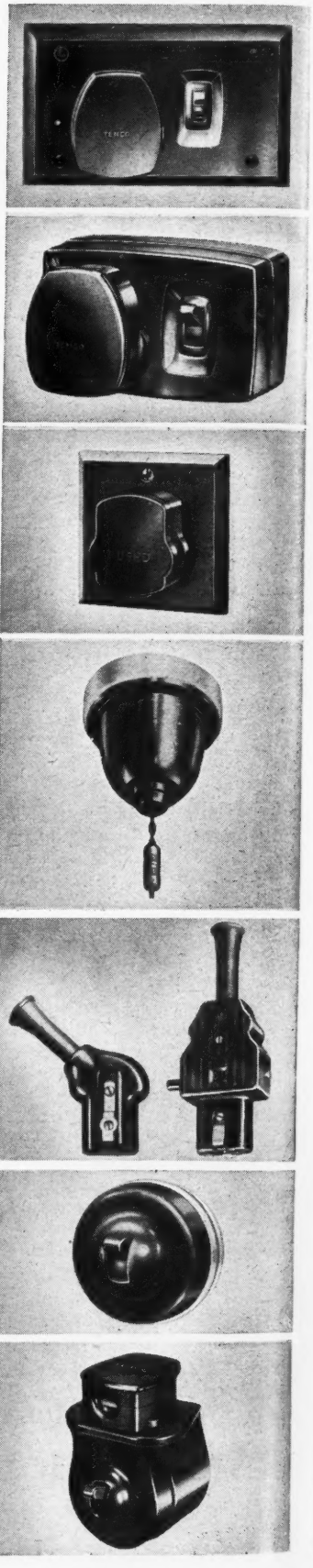

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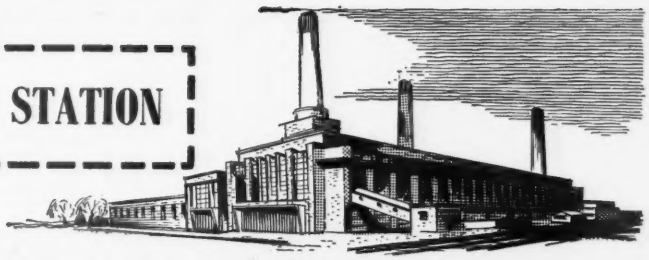
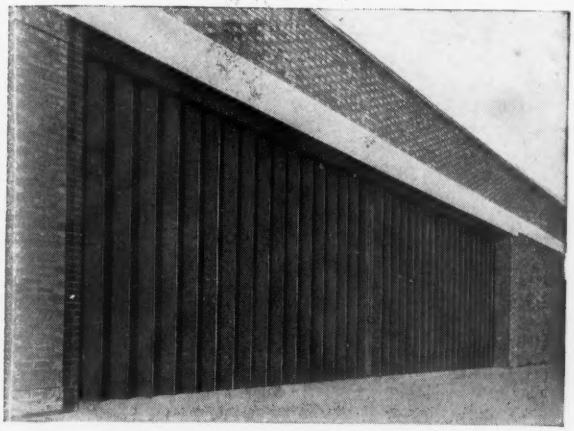


*demands the MODERN SHUTTER DOOR*



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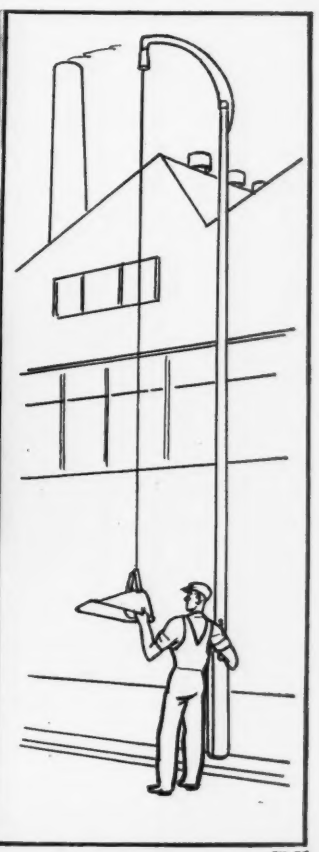

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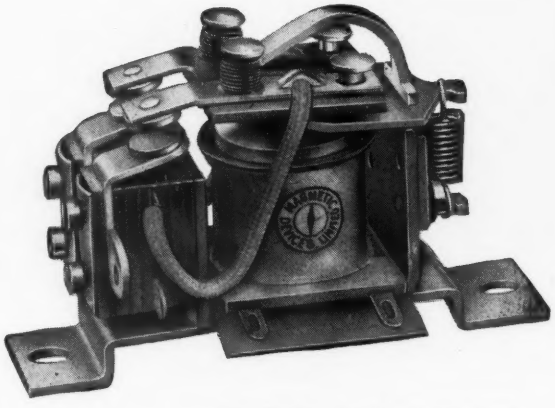

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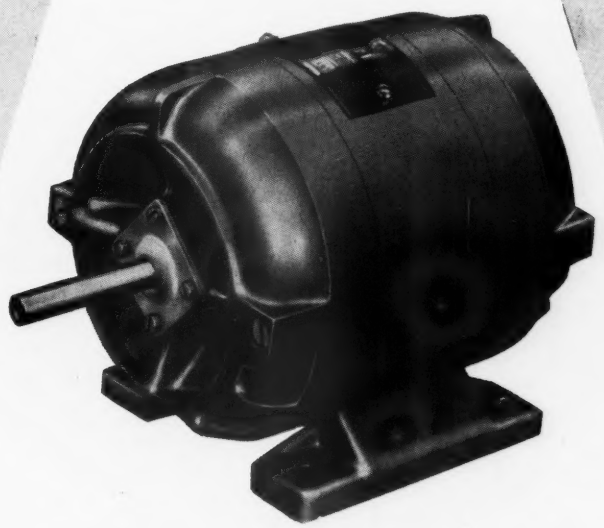

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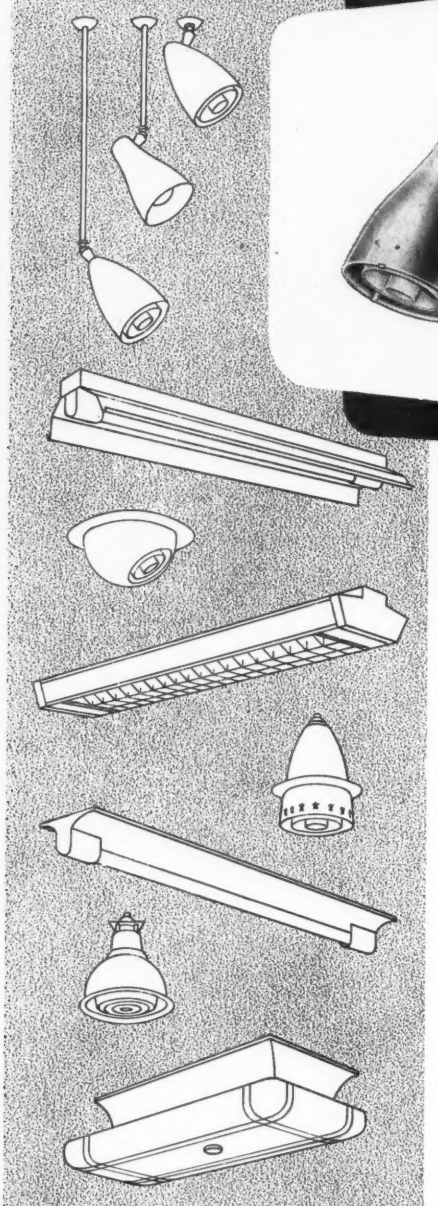

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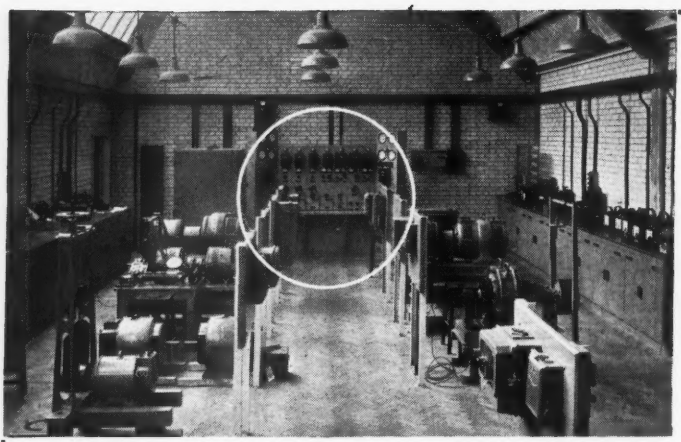

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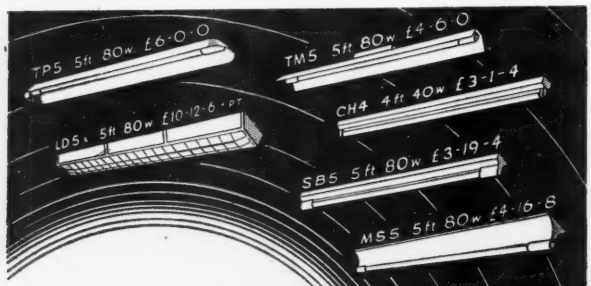


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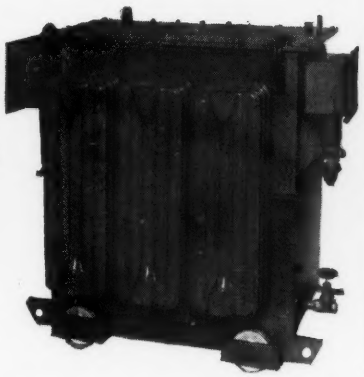

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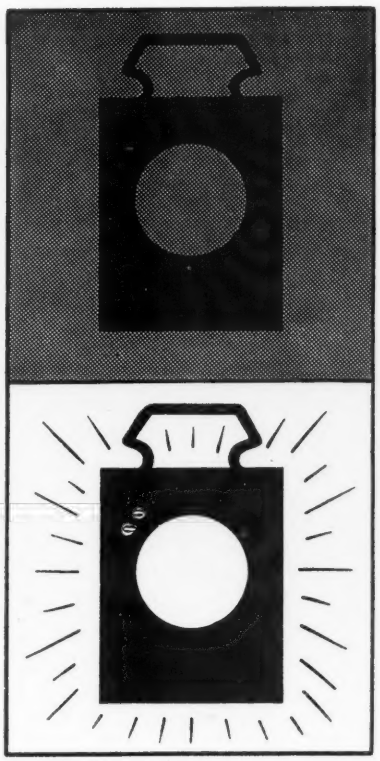

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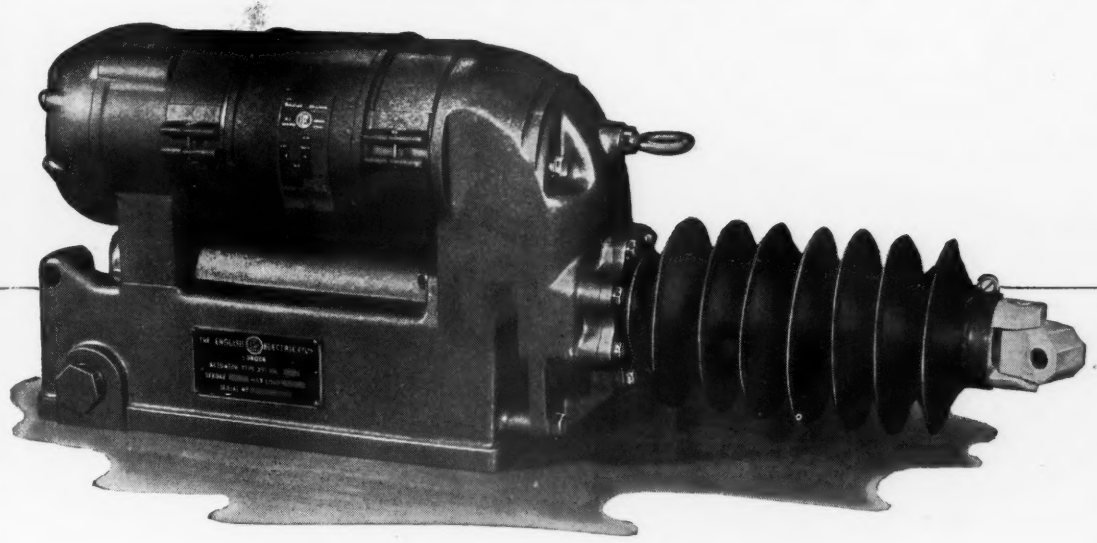

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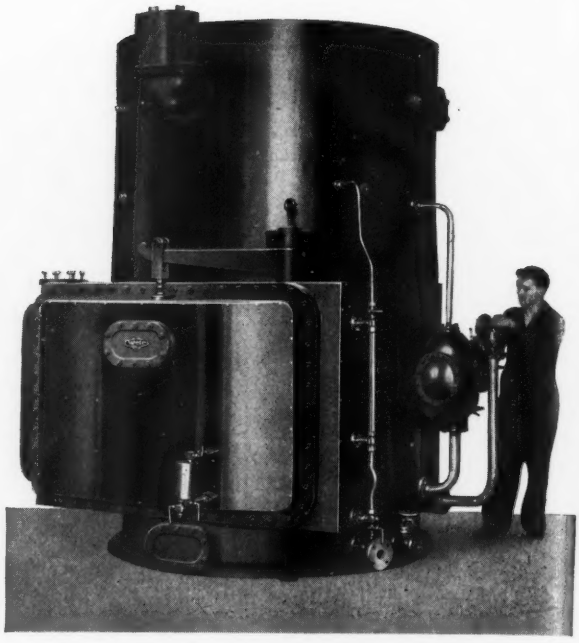

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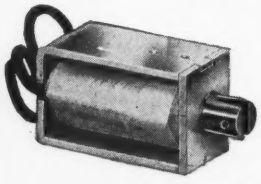

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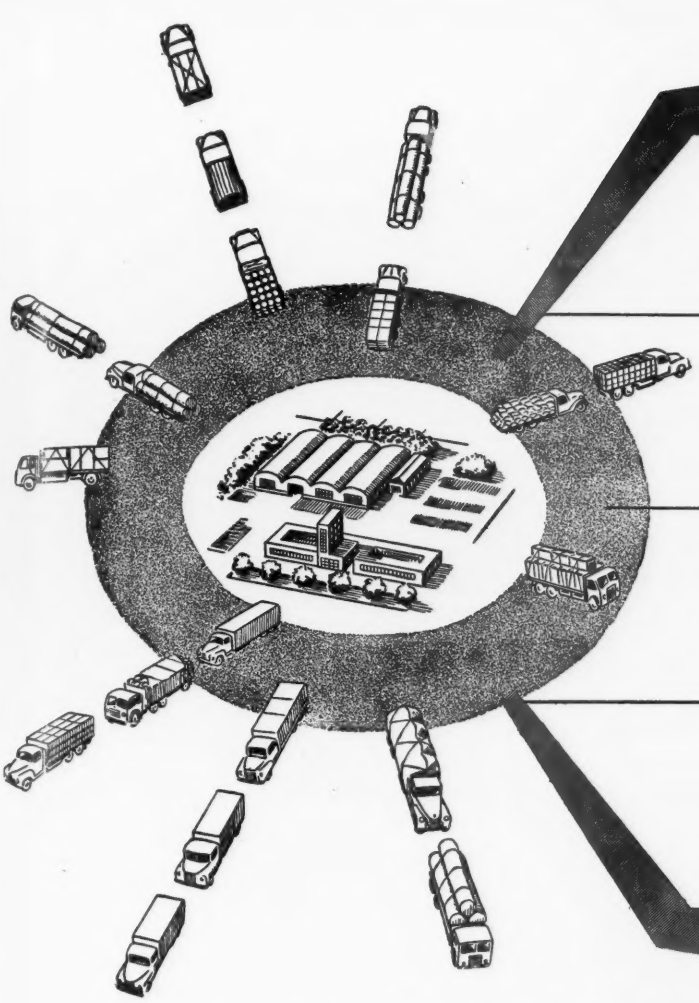

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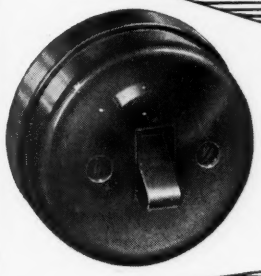

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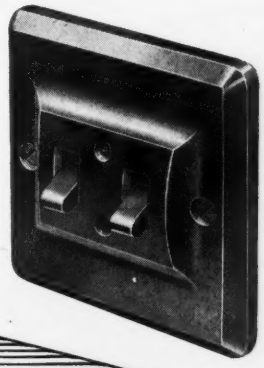
TWIN UNIT (as illustrated). Switches housed behind a single detachable plate. Choice of 3 combinations: two 1-way, two 2-way, or one 1-way and one 2-way.



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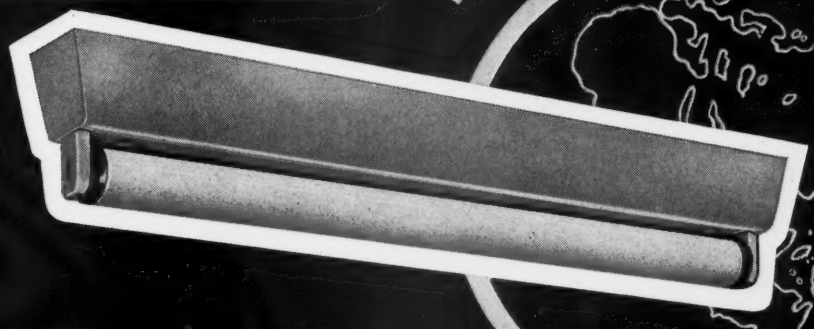

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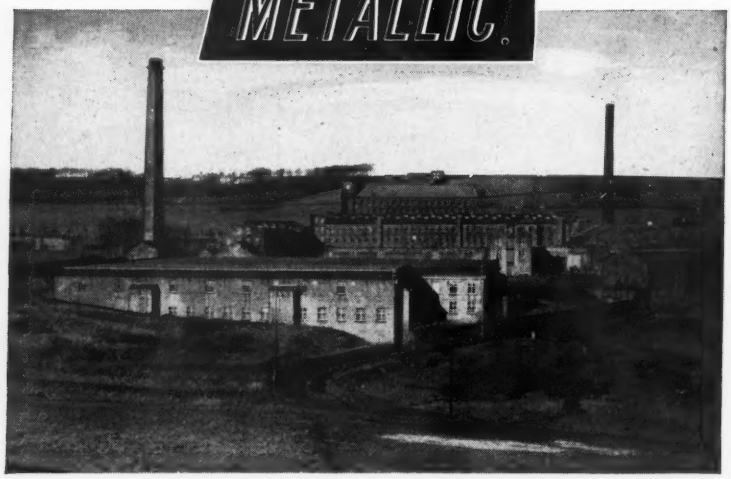

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*Denholme Mills, Nr. Keighley. Photo by courtesy of W. & H. Foster Ltd.*

*Electrical Contractorsf or this important installation : A. R. Farrar & Co. Ltd.*

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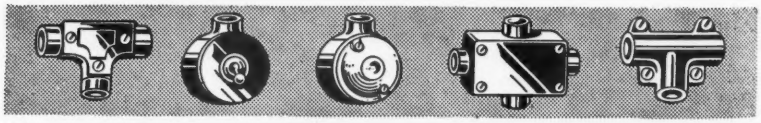

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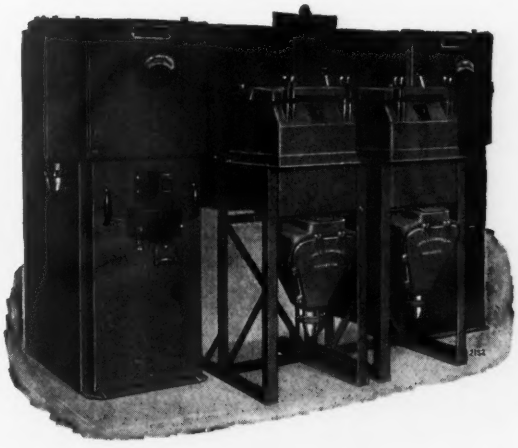

The oil fuse circuit breaker is part of a versatile range of economical outdoor switchgear for 11kV service.

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# page 600

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TWO BENT TUBE TWO-DRUM WATERTUBE BOILERS and auxiliary equipment for Transportable Power Stations, by Mitchell Engineering Ltd., Peterborough. Arranged for Mechanical Stoker firing with Illinois Chain Grate Stokers, and Oil firing with Wallsend equipment. Evap. each Boiler when coal fired being 33,000 lb. hr., at 375 lb. sq. in. W.P., with Superheater giving final steam temperature of 650° F. Equipment includes Greens Economiser; Weir Feed Pumps; Howdens F.D. and I.D. Fans. Boilers supplied in 1946 and used for 3 years. Full specification and drawings available.

BABCOCK & WILCOX DESIGNTREBLE-DRUM WATERTUBE BOILER by Goldie & McCulloch. Manufactured 1941, installed 1944. Have been in service three months. Insured for W.P. 250 lb. sq. in. Normal Evap. 15,000 lb. hr. With fittings, mountings, oil burning equipment by Wallsend Slipway Company, including Howden Forced Draught Fan, Oil Pump, Heaters, Filters, etc. Drawings available.

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TWO SELF-CONTAINED SUPER ECONOMIC BOILERS by John Thompson & Co. Ltd., Wolverhampton, Makers' Nos. 7991/2, manufactured 1942. Evap. 10,000 lb. steam/hr. each, at a working pressure of 120 lb. sq. in. Dimensions 19 ft. 7 in. long × 15 ft. long over tubeplates × 9 ft. 6 in. diameter; with 2 furnaces and equipped with "Niagara" Sprinkler type Stokers.

SELF-CONTAINED ECONOMIC BOILER by Davey Paxman. Evap. 4,500 lb. hr. at W.P. of 140 lb. sq. in. Dimensions overall length 16 ft. 6 in. × 12 ft. 6 in. between tubeplates × 7 ft. 6 in. dia. The boiler, which is equipped with 2 furnaces, is arranged for hand coal firing.

Three Twin Flue, self-contained Economic Boilers by Edwin Danks. Overall length 17 ft. 6 in., over tubeplates 14 ft. ×8 ft. dia. W.P. 150 lb. sq. in. Heating surface 1,175 sq. ft. Evap. 7,000 lb. hr. Fitted combustion chamber. Superheater to give final steam temperature 500/550° F.

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TWO NEW LANCASHIRE BOILERS by Daniel Adamson & Co. Ltd., Dukinfield. Dimensions 30 ft. × 9 ft. dia. Patent Unidish type, i.e. dished one end flat the other. Evap. 10,200 lb. steam/hr. when hand fired or 10,500 lb. steam/hr. stoker fired, at W.P. 250 lb. sq. in. Equipped with usual set of Hopkinsons steam and water fittings.

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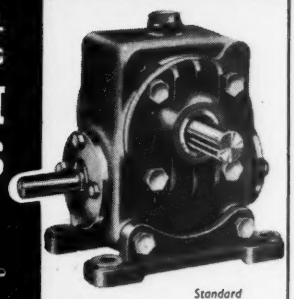

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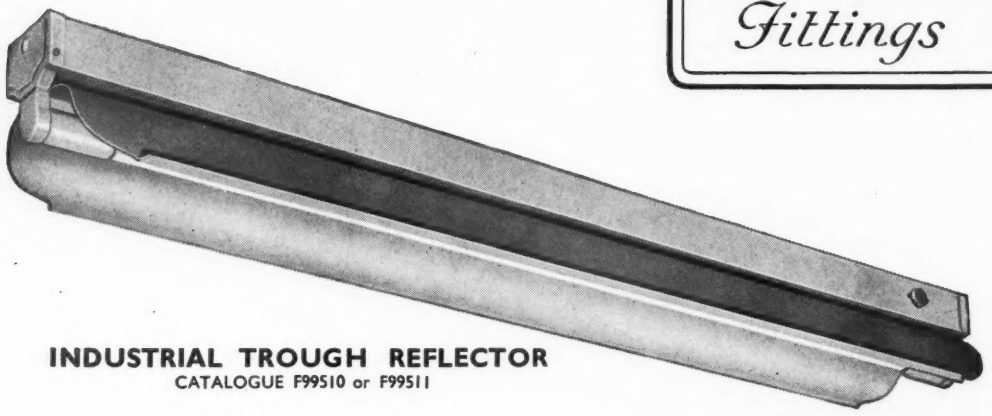

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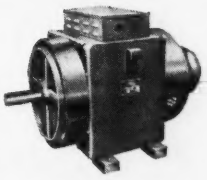

of unique design providing an alternator of smaller dimensions and less weight than any other machines of equivalent outputs. Designed for lighting sets powered by i.c. engines. The range covers 1½–35 kVA.

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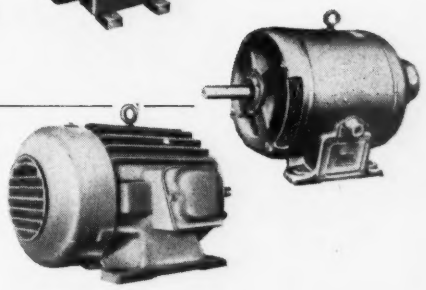

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Lighting output Ratio exceeds 85%. Balanced distribution— 10-25% upward light.

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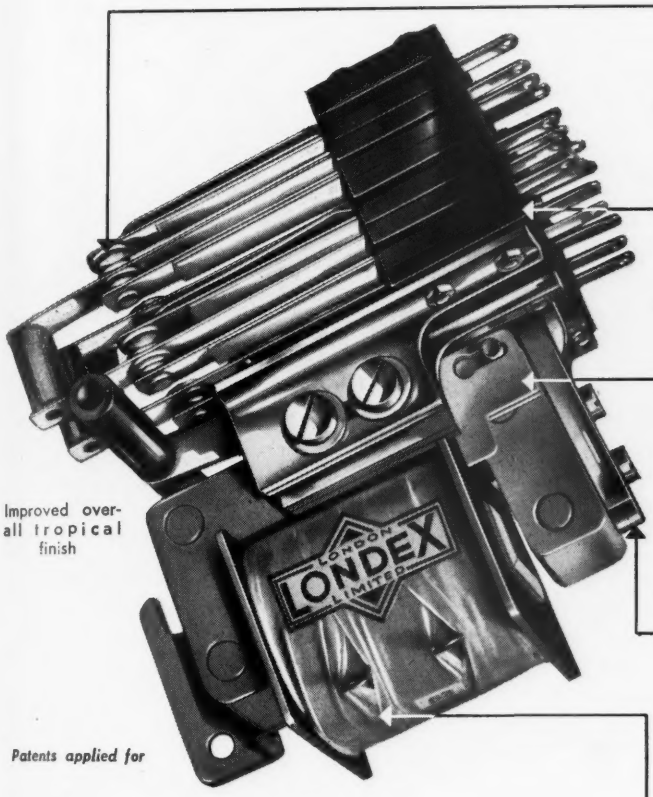
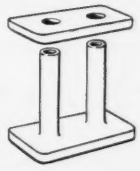


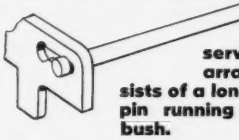

Improved overall tropical finish

*Patents applied for*

Larger contact points of solid silver



New type insulators and sleeves moulded as one unit from high grade material HD 220. Resistant to solder heat



Heavy duty—General service types. This arrangement consists of a long stainless steel pin running in a ¾" brass bush.

Heavy duty—Ultra high speed types. Ball-bearing pivot. Patent No. 560430.

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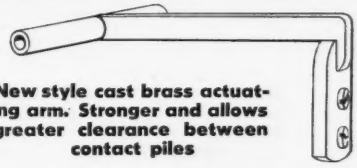
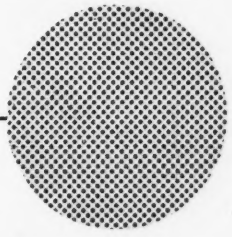


New style cast brass actuating arm. Stronger and allows greater clearance between contact piles



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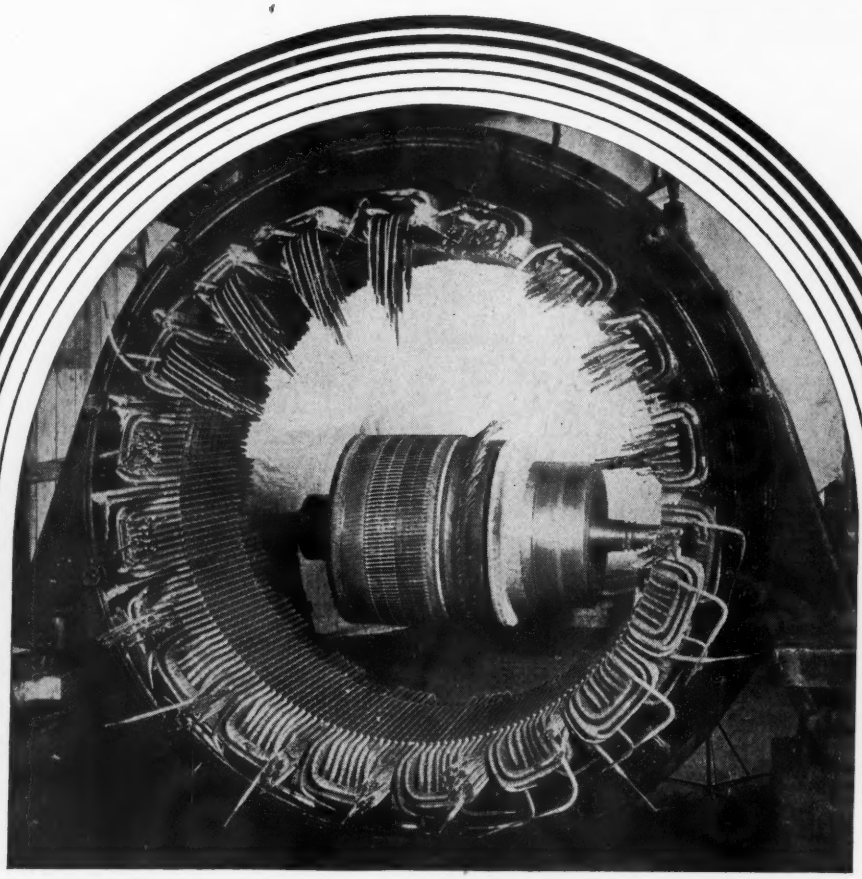

**Variety.** Collins' comprehensive experience ensures there is always at least one interesting job going through their works. Here is the stator of a 1250 H.P., 6,600 V., 246 r.p.m. English Electric Motor undergoing complete rewind. In the background is an Armature from a 250 H.P. B.T.H. C.H.T. variable speed motor.

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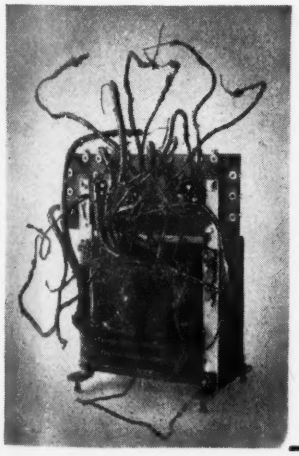
*The illustration shows a stage in the manufacture of transformer coils by Associated Electronic Engineers Ltd*



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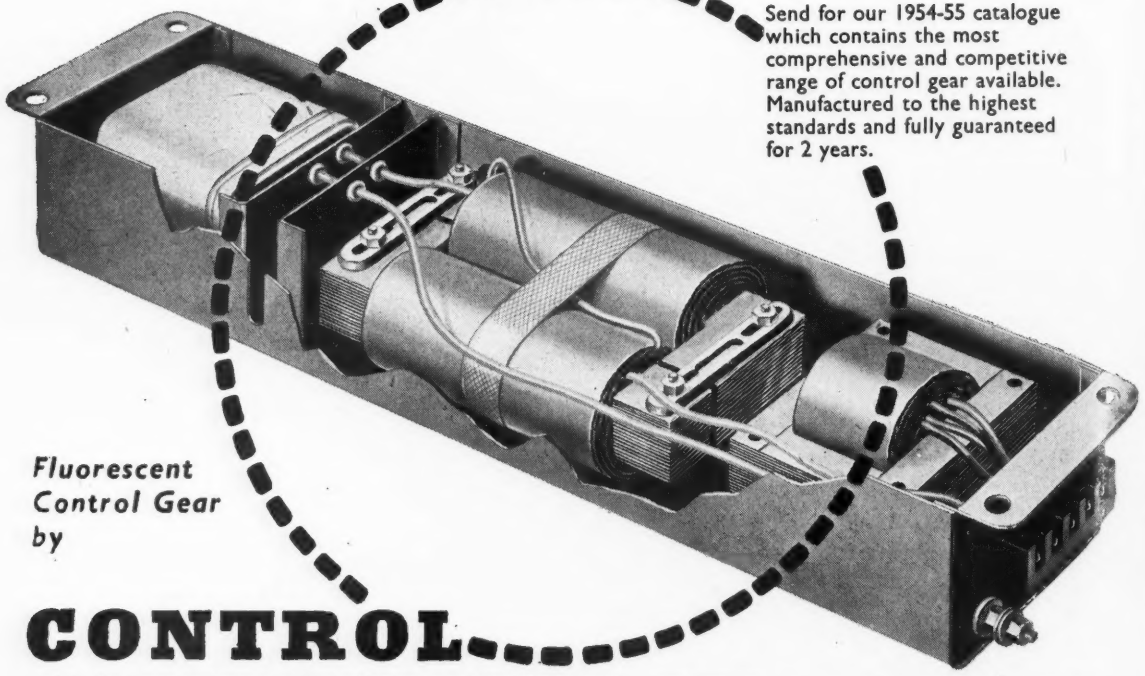

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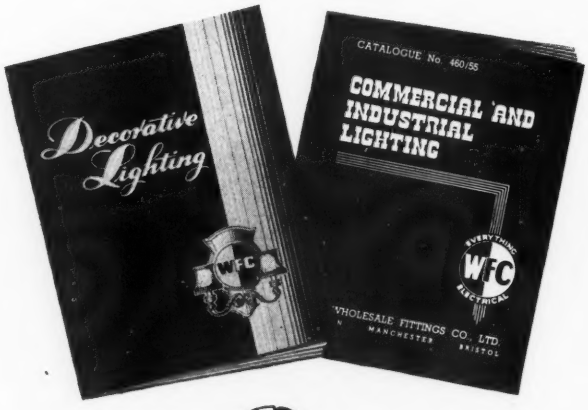


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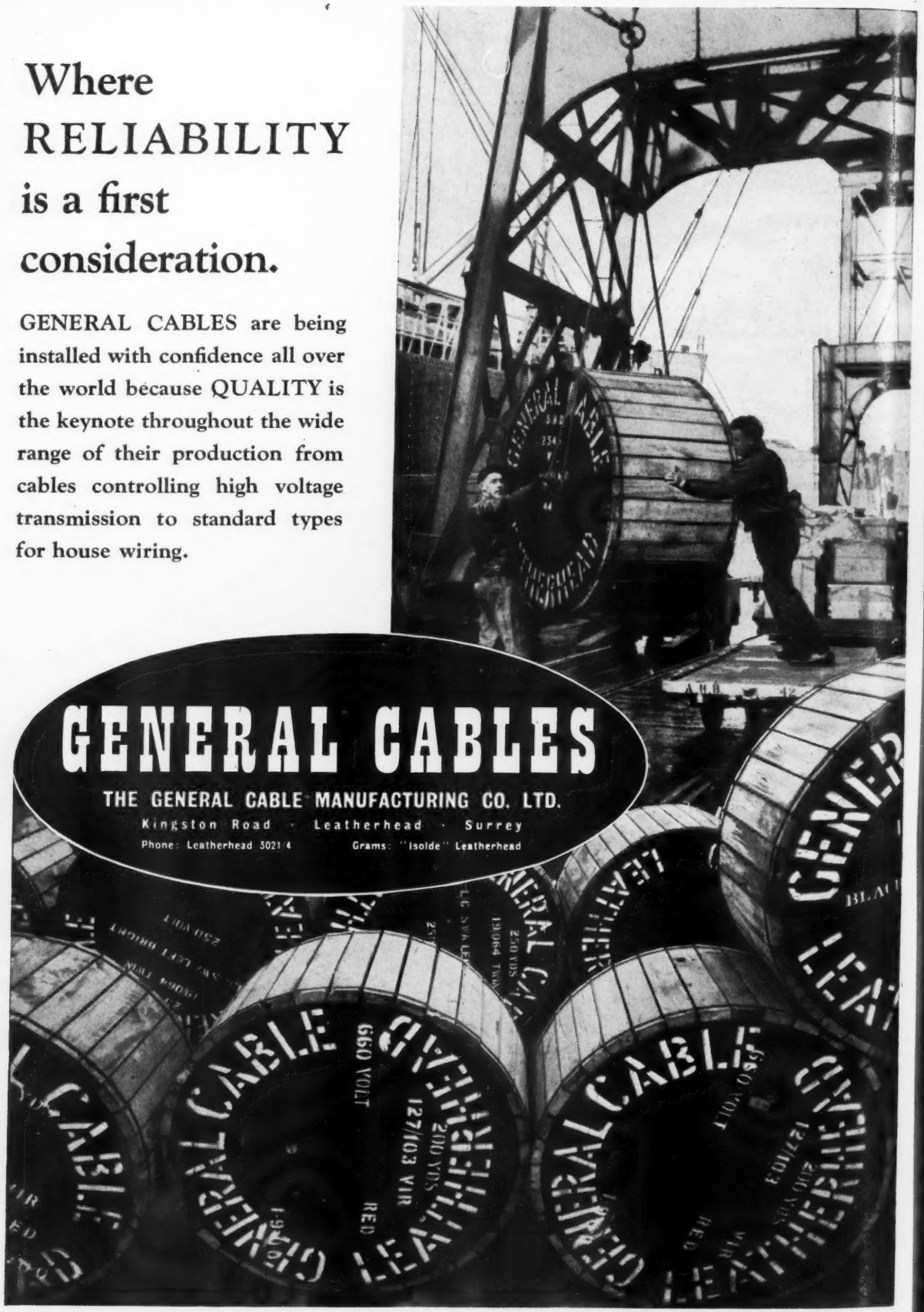

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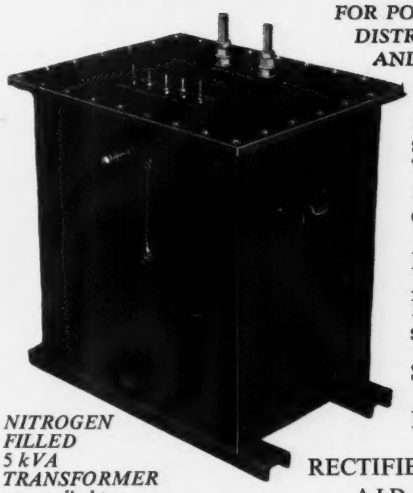

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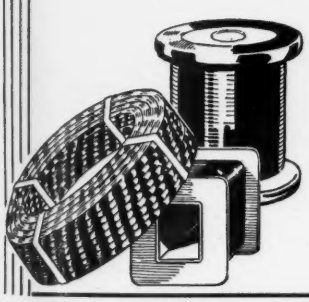

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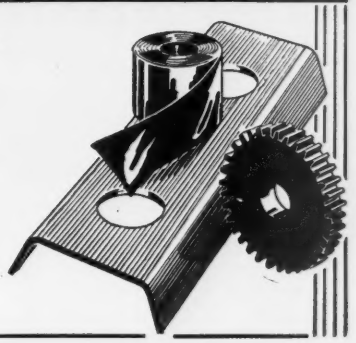

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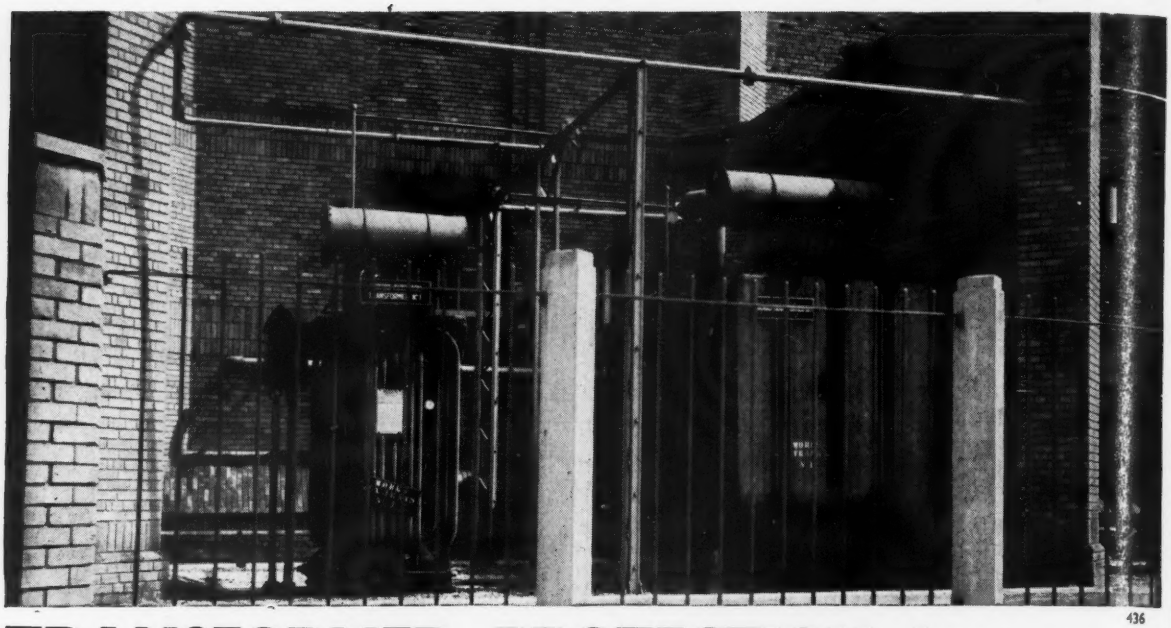

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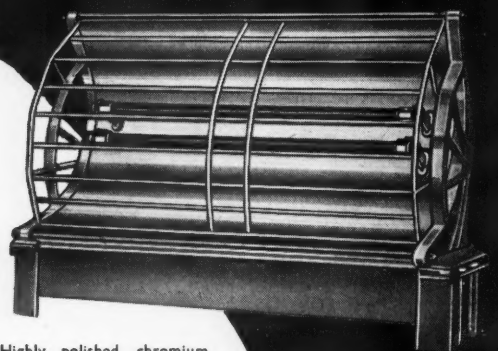

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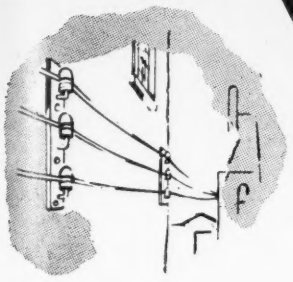

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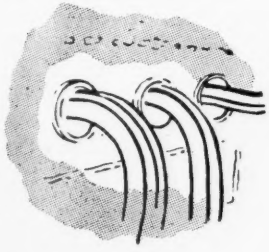

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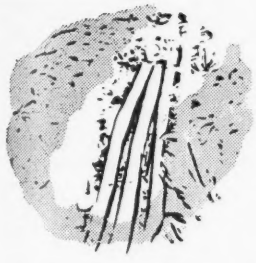

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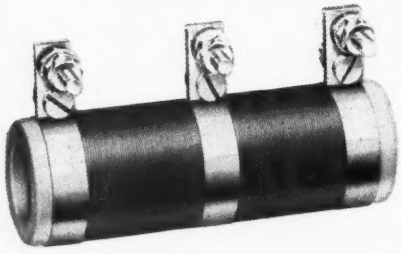

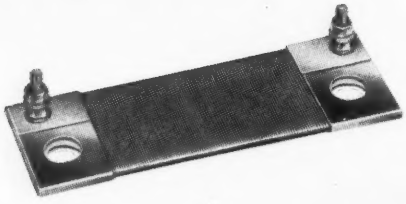

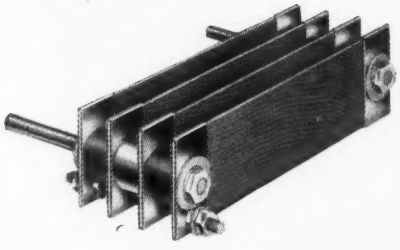

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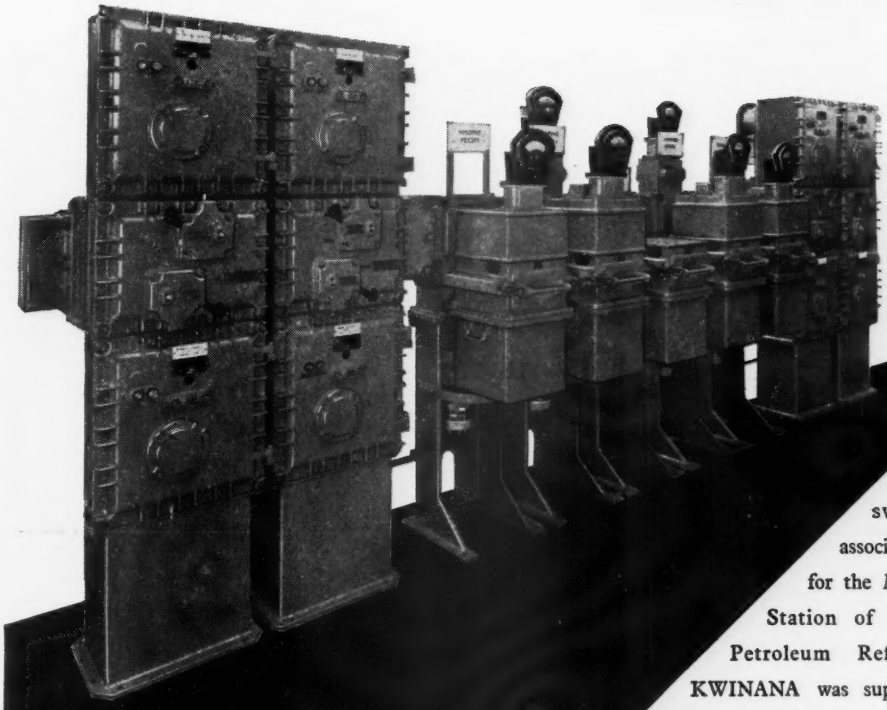

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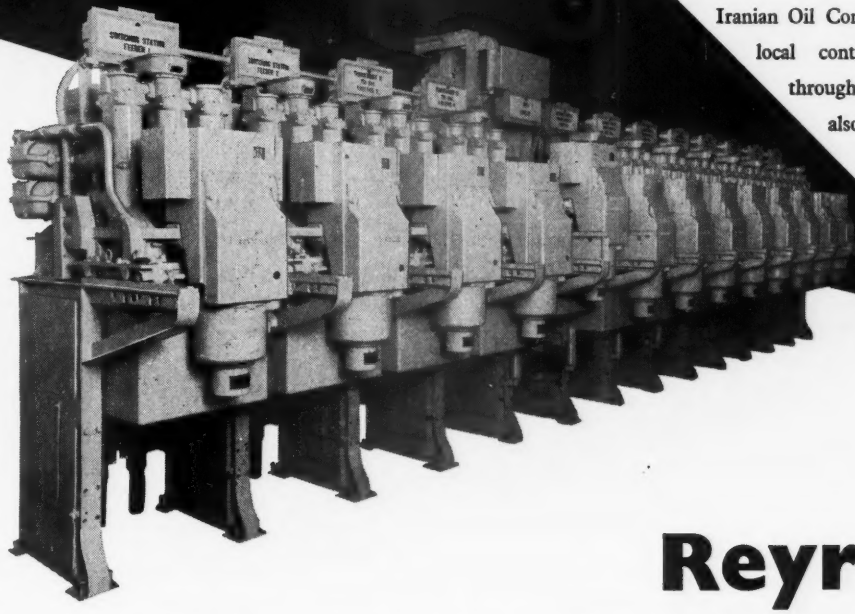

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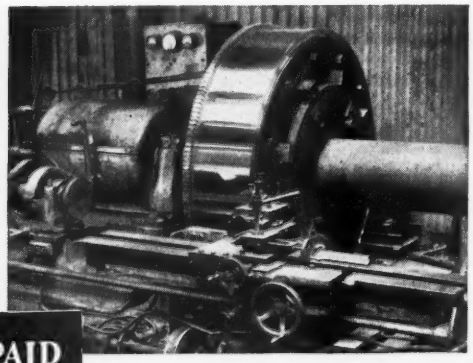

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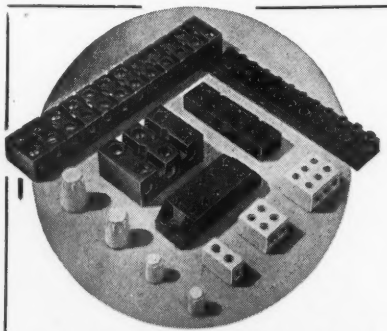

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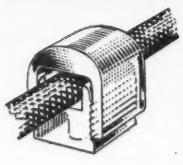

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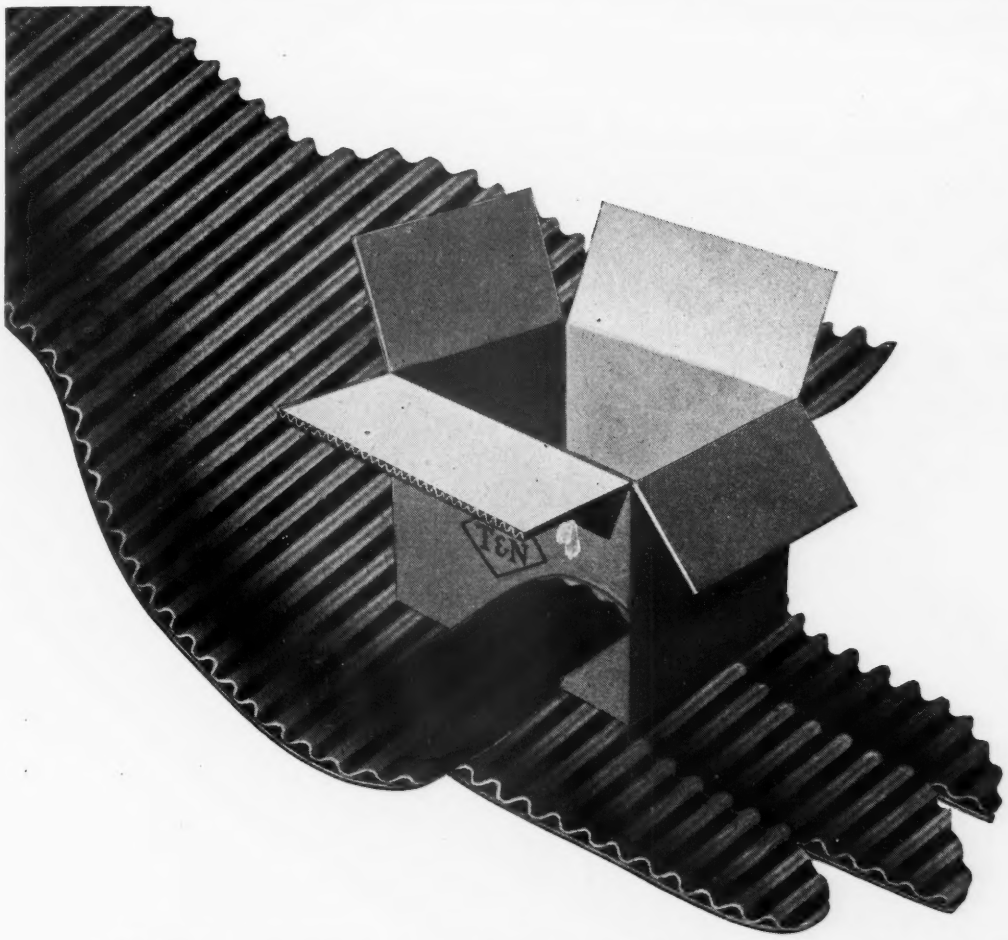


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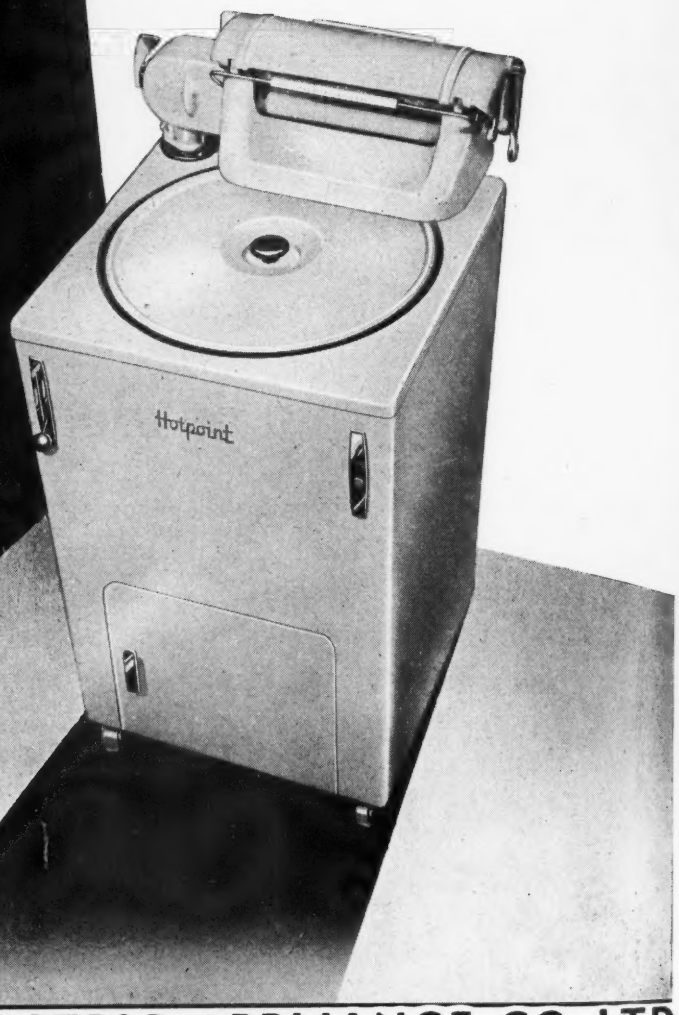


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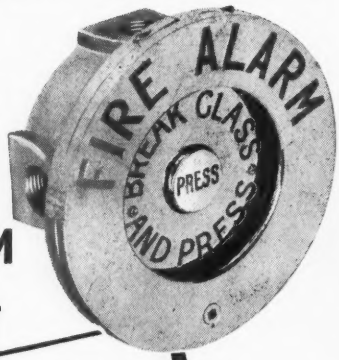


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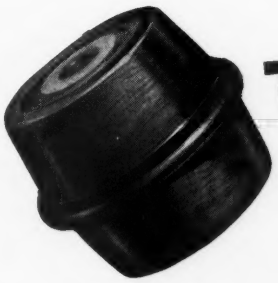
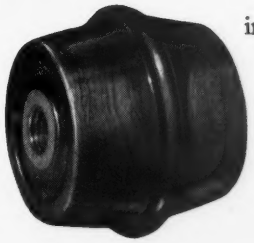


# TUFNOL Barrel Insulators

## in convenient cartons



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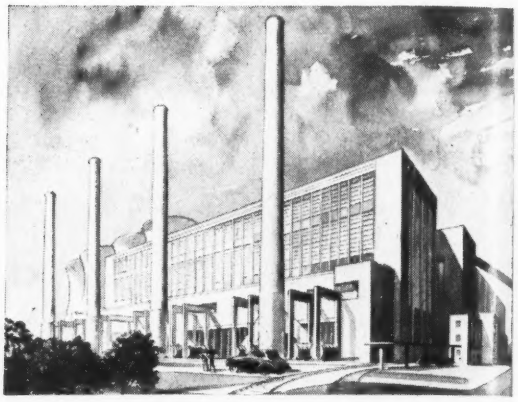
# Taaibos POWER STATION

## LARGEST BOILERS IN SOUTH AFRICA



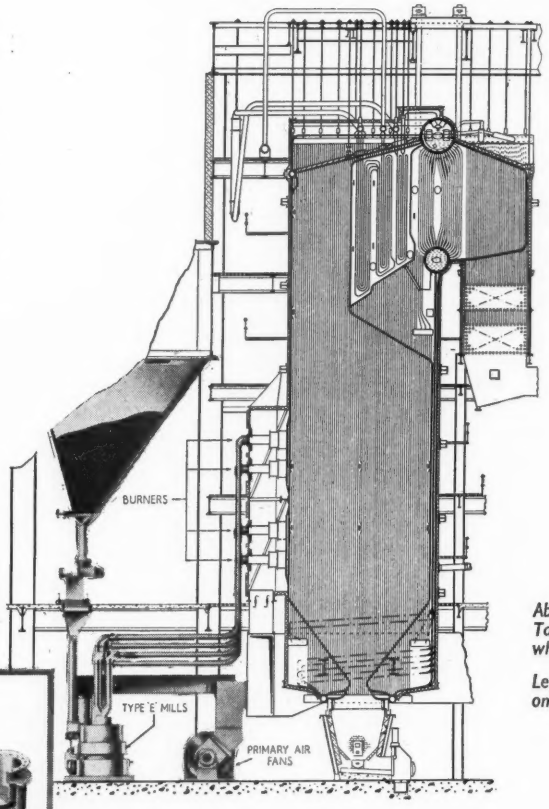
THE eight 580,000 lb./hr. Babcock boilers for the new Taaibos power station of the Rand Undertaking*, of which the first units will soon be in commission, will be the largest boilers in South Africa.

Of modern, Bi-drum design, over 130 feet in height they are pulverized-fuel-fired, using low-grade coal from the coal field on which the station is being built; each boiler being served by four Babcock type E pulverizing mills, so connected to the sixteen horizontal intertube circular p.f. burners as to ensure even flame distribution at reduced loads, with one or more mills shut down.

Ash and dust handling are by the Babcock *Hydrojet* and *Hydrovac* systems.

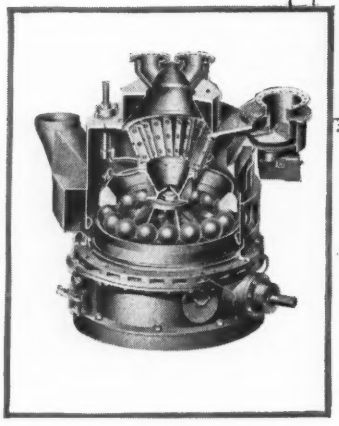
Taaibos is a major undertaking in an impressive programme of South African electrical development, for which over 60 per cent of the steam-raising plant is being supplied by Babcock & Wilcox.

** Electricity Supply Commission of the Union of South Africa.*




*Above: Impression of Taaibos power station when completed.*

*Left: Arrangement of one of the boilers.*



*Sectional view of the Babcock type E pulverizing mill, with integral classifier, of which 32 are being supplied for Taaibos power station.*

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# ELECTRICAL REVIEW

*Managing Editor:* HUGH S. POCOCK, M.I.E.E.
*General Editor:* J. H. COSENS
*Technical Editor:* P. W. TUCKER, M.I.E.E.

10 DECEMBER 1954

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VOLUME 155 ✧ NUMBER 24

*Eighty-Third Year of Publication*

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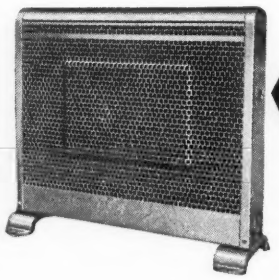


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ELECTRICAL REVIEW

10 December 1954 Vol. 155 No. 24 Established 1872

# The Industry and the B.I.F.

IN the past three or four years there has been a drastic reduction in the number of purely electrical exhibitors in the Electrical Section of the British Industries Fair, Birmingham. The Fair Management Committee has filled the space which used to be occupied by electrical concerns with many exhibitors whose connections with the electrical manufacturing industry are slight. The rate of attrition is now so rapid that a decision upon continuance or withdrawal has become urgent.

It has always been our view that in any British export fair the great electrical manufacturing industry must be represented; after all it is now the second largest exporter. If the Fair has lost its original character the position is not so clear, but it is still officially proclaimed to be an export exhibition and it is widely publicized as such overseas.

Those electrical exhibitors who have dropped out argue that overseas visitors to Birmingham are too few to justify the claim, although some of them believe that the London section fares better in this respect. Another complicating factor is the successful Electrical Engineers' (A.S.E.E.) Exhibition which the promoters are endeavouring to make an export display. Electrical manufacturers are becoming reluctant to show at two more or less similar exhibitions within the space of a month or so.

When the matter was put up to the British Electrical and Allied Manufacturers' Association, as being the most representative body for the purpose, that Association appointed a committee to study the subject. The committee's recommendations were that the Electrical Section of the Fair should be moved from Birmingham to London; that the Section should be organized biennially, alternating with a section from another industry if necessary; and that the alterations should take effect from the 1956 Fair. The committee shared the view which we have expressed that it would be unfortunate if such an important export industry were unrepresented in the Fair.

There are a faithful few who wish to remain in the Birmingham Section and, indeed, there is much to be said for remaining. It is the " heavy " section of the Fair and much of the electrical equipment shown would not fit in very well with the general character of the London display. The arrangements at Birmingham are now more satisfactory than they used to be and Birmingham is a centre of heavy industry. But these few will find it difficult to sway the majority of potential exhibitors, however desirable it may be to preserve the Birmingham Electrical Section. The whole subject is now under discussion and certain proposals are being investigated by the Electrical Exhibitors' Committee.

While it may be possible for individual exhibitors to revert to the original arrangement by which they were fitted into one of the general groups at Birmingham (Hardware, Building and Engineering)—an arrangement which still holds to a small extent—it would be a great pity if the electrical industry thus lost its identity in the Fair.

## INDIAN INDUSTRY

In a report in this issue our Bombay Correspondent makes reference to the Industrial Credit and Investment Corporation of India. This is an international financing organization in which the Government of India has a share, its purpose being to provide funds for the development of industry in India by private enterprise. Last week-end some particulars of the new Corporation were published. It will have an authorized capital of £18¾ million subscribed by the Indian Government, the International Bank, the Commonwealth Finance Development Corporation (London), the Bank of America, Rockefeller Bros., the Westinghouse Electric & Manufacturing Co. and the Olin Mathieson Chemical Corporation. An Indian "steering committee" has been appointed with Mr. P. S. Beale, chief cashier of the Bank of England (whose signature appears on current banknotes), as general manager. The activities of the Corporation will be of great significance and interest to British electrical manufacturers, particularly as the American Westinghouse Co. is one of the parties to the plan. It is the aim of the Indian Government to foster the development of home industries. Much has already been done but, in spite of protective measures, progress has not been so rapid as was desired by the Government. Such endeavours towards self-sufficiency are likely to have adverse effects upon British electrical exports to one of our principal markets. As in other parts of the world, we can seek compensation for this only by investment and the supply of capital goods.

## VARIABLE-SPEED A.C. MOTORS

The chief disadvantage attending the use of the robust and relatively inexpensive three-phase squirrel cage motor in many cases is that it is essentially a constant-speed machine. To provide speed variation entails sacrifice of its attractive simplicity through such modifications as a wound rotor with slip-rings or a commutator or, in limited coarse steps, through pole changing. The investigation carried out by Professor F. C. Williams and Mr. E. R. Laithwaite and set out in their paper (summarized in this issue) presented before the Institution of Electrical Engineers indicates the possibility of producing an a.c. motor which, while retaining the squirrel cage motor's freedom from rubbing contacts and switches, could give continuously variable speeds. Results obtained with their experimental machines, though in embryonic form and on a small scale, appear to justify further development of this line of research.

## MEDICAL X-RAY APPARATUS

With the increasing use of X-rays as an aid to diagnosis in an ever-widening field of medicine, there has been steady progress in the design of equipment. This was well brought out at the exhibition of X-ray apparatus held in London recently in conjunction with the sixteenth annual congress of the British Institute of Radiology. Notable advances indicated by the exhibits included image amplifiers, which are electronic devices capable of enormously intensifying the brightness of X-ray images for visual examinations, and X-ray cameras with which radiographs of reduced size can be produced, thereby effecting great savings in the cost of film. The latter development offers the possibility of using X-rays far more extensively than has been the case in the past, particularly for the examination of the lungs of apparently healthy people. In this way a further step will be taken towards eliminating tuberculosis, mass X-ray examinations having already contributed towards a dramatic fall in deaths from this cause. Examination equipment generally is greatly improved technically and there are X-ray tables which tilt through 180 deg at the touch of a button, devices for taking a series of pictures of the stomach or heart in rapid succession, and others which will show the condition of any given "slice" of the body.

## REPORTING PROGRESS

Belief in the desirability of disseminating knowledge of scientific progress to the public at large was a chief consideration of those who founded the British Association in 1831—a year that was notable for the discovery by Faraday of the principle of electromagnetic induction. As Faraday shared this view, the semi-popular lectures that bear his name are peculiarly apt to the purpose. Actually they, like the British Association meetings, tend to have a further end in view. They are addressed not only to an intelligent lay public but also to scientists and engineers who, with necessarily increasing specialization, find it difficult to keep in touch with developments in other fields. Few "heavy current" men, for instance, could not profit by this year's Faraday Lecture by Mr. T. B. D. Terroni. A summary of the Lecture, which was first delivered before the Merseyside and North Wales Centre of the Institution of Electrical Engineers at Liverpool on Monday last, appears on page 935.

## LABRADOR POWER SCHEME

Last year British and Canadian interests formed the British Newfoundland Corporation to investigate the development of the natural resources of parts of Newfoundland and Labrador. It is now surveying the possibilities of the Hamilton River, Labrador, as a source of hydro-electric power; it is estimated that at Grand Falls on that river it should be possible to develop up to 3 million h.p. Although initially the power would have to be transmitted over a distance of about 300 miles to existing industrial areas, it is believed that the availability of cheap power might attract industrialists to the more immediate area. The Corporation aims at exploiting mineral, water power and timber resources and this is reflected in its composition. There were originally twenty concerns in the Corporation; seven others have recently joined it. It includes the English Electric Co., Ltd., and British Insulated Callender's Cables, Ltd. It is contemplated that the first stage of the Hamilton River hydro-electric project would develop 1 million h.p., at a cost of between $150 and $250 million, by about 1962.

# Technical College Installation

## EXTENSIONS AND RE-EQUIPMENT AT WEDNESBURY

CONSIDERABLE alterations and extensions to the electrical facilities have recently been carried out for the Staffordshire Education Committee at the County Technical College, Wednesbury, which to a great extent specializes in engineering and metallurgy, and in the following paragraphs an account of the installation is given, together with details of some of the apparatus in the various laboratories of the College which is of electrical or general interest.

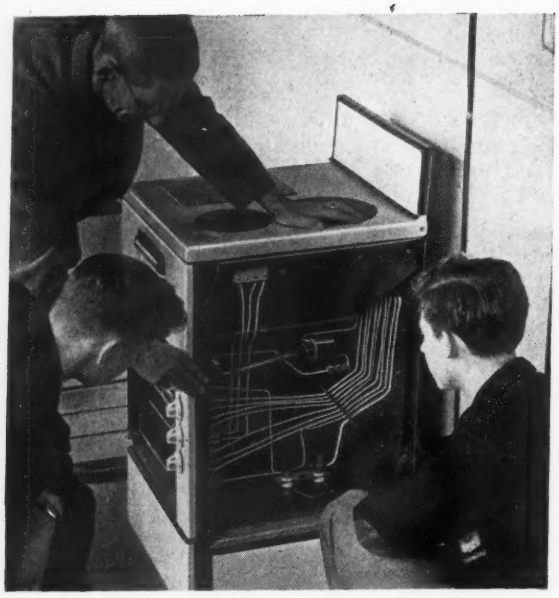
The original premises, together with a large extension on the opposite side of the main road, are supplied by the Midlands Electricity Board with a two-phase supply at 7,000 V. The supply enters a substation situated in the new extension and is transformed to 415 V three-phase supply by two Bruce Peebles 200 kVA transformers which are Scott connected to the incoming two-phase supply. The three-phase supply is fed through an Ellison switch to a busbar chamber and distribution board on which are mounted isolators feeding the various blocks of buildings comprising the extensions, the original College buildings, and a 109 kW English Electric mercury arc rectifier providing d.c. for certain purposes. The switchgear and boards have been manufactured by Wm. Sanders & Co. (Wednesbury), Ltd.

In classrooms and some laboratories the lighting fixtures are "Petworth" and "Thorlux," whilst the latter are also used for the majority of the shops. The drawing offices, metrology laboratory and metallurgical analysis laboratory, are lit by instant start fluorescent tubes in Crompton fittings. "Warm white" tubes are used for the two former applications and colour matching tubes in the analysis laboratory. The new 13 A socket has been standardized throughout the new installation. Low voltage a.c. and d.c. supplies for various laboratories and demonstration benches are available from local units supplied by Legg (Industries), Ltd., and Labgear (Cambridge), Ltd. The contractors were Hartley Electromotives, Ltd.

In the various shops and laboratories there is much of electrical interest. The workshops of the engineering department are equipped with an English Electric overhead busbar system. Ellison isolators are provided for the busbars and these may be tripped from a number of safety "knock off" points so that in the event of a major fault the shops can be shut down in the minimum of time. All machine tools, of which there are some seventy-five, are provided with individual drive. Where local lighting is desirable Igranic 50 V 50 W equipment has been installed. The motor installations call for no comment except for the drive to the Newall jig borer, which is of the Ward-Leonard pattern. The machines are mainly of post-war manufacture and include a comprehensive range of centre lathes, milling, shaping, slotting, drilling, and grinding machines, together with a turret and capstan section. A range of machines in a separate production engineering laboratory are to be fully instrumented with wattmeters, dynamometers, etc., for research work in machining operations.

The electrical laboratory is equipped to cater for National Certificate work and the applied electricity syllabus of

*A general view of the electrical installation laboratory at the Staffordshire County Technical College, Wednesbury*



*Domestic section of the electrical installation laboratory*

the London University B.Sc. degree. This laboratory is now being reorganized pending the provision of a new laboratory to be housed in a major building extension on which work will commence in 1955. Existing equipment includes a motor alternator set and two d.c. motor-generator sets with the usual auxiliary starting and control gear, a mercury arc rectifier unit and portable resistance units for breaking up the load. The laboratory is fully equipped with the usual routine instruments and test sets. Items of electrical interest in the motive power laboratory are a six-cylinder petrol engine and generator arranged for Morse tests, a Crossley semi-diesel engine and a d.c. generator with variable resistance load, and a dual air compressor set fitted with a Mawdsley swinging field dynamometer.

In the recent extension is a laboratory established to assist in electrical installation courses for the City and Guilds " B " certificate. Here facilities are provided for practical training in working on different types of wall surfaces and with different classes of apparatus, separate small cubicles being specially laid out for the installation respectively of small industrial power plant, general domestic apparatus, bathroom fittings, and kitchen equipment, including cooker, control switch, fuses, meter and earth leakage trip.

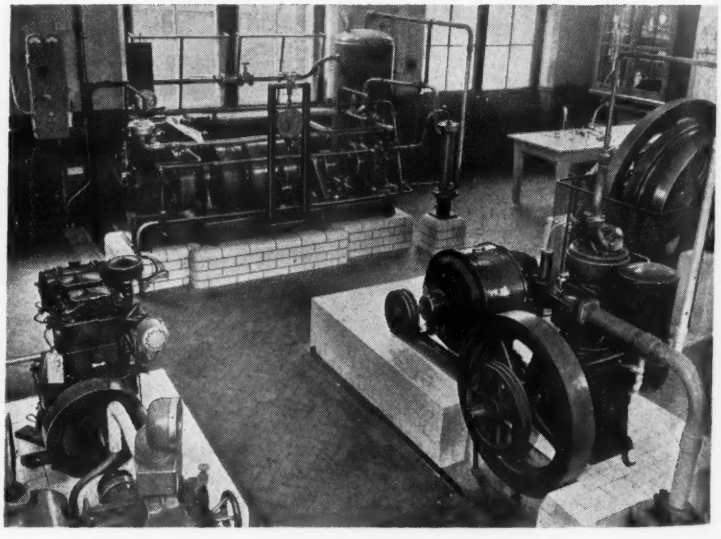
A four-cylinder petrol engine is arranged to drive a compound wound d.c. generator, while another small petrol engine unit drives an alternator incorporating an auto-transformer for stepping up from 110 V to 230 V. For load testing and power factor a 5 kW generator is also being installed with two methods of driving, slip ring and squirrel cage, together with all kinds of starting methods. A bank of batteries with charging equipment made up by the students furnishes a 12 V supply to the work benches, the necessary wiring being carried out in Pyrotenax.

While not of direct interest from an electrical point of view, mention may be made of the metrology laboratory, one of the finest of its kind which has been approved by the National Physical Laboratory. In addition to its function as a teaching laboratory, much inspection work is undertaken for industry. Equipment includes a Watts microptic measuring machine, Watts interferometer, Taylor-Hobson " Talysurf," surface finish analyser, Hilger " Angle Dekkor," many comparators and a range of machines of N.P.L. design for thread measurement, pitch measurement, profile projection, etc.

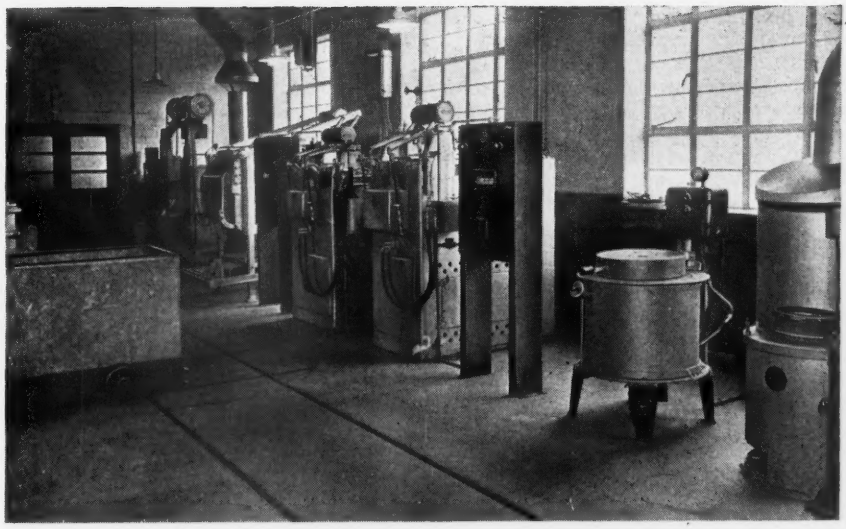
In addition to the usual range of testing machines the strength of materials laboratory contains a Parsons strain gauge recorder and a Norwood optical bench for photo-elastic stress analysis.

Many examples of electrical apparatus are to be found in the department of metallurgy. The welding shop contains a six-operator a.c. set and a four-operator d.c. set, together with a flash butt welder and spot welder. The heat-treatment shop, which is equipped with industrial scale plant, contains a variety of furnaces and offers a heat-treatment service to local industry. Electric furnaces include muffles, a salt bath and a forced air circulation furnace. Gas fired furnaces are also available. The electric furnaces are supplied with low voltage current from local transformers and are potentiometrically controlled. A 30 kVA high frequency spark gap type furnace is available elsewhere for high temperature melting.

The mechanical working laboratory contains a pneumatic forging hammer, a drop stamp, a rolling mill and a draw bench. The last two items of plant have been fully instrumented for experimental work and are fitted with recording wattmeters and electrical tachometers. Load cells have been installed under the mill screws and the die holder of the draw bench. In the former case the load cell output is fed to individual electronically controlled indicators calibrated directly in tons. In the case of the draw bench the output from these load cells is fed to a single integrating indicator. The equipment for this installation was manufactured by Elliott Brothers, Ltd. Speed control is effected by means of Brookhirst and Verity



*In the motive power laboratory are petrol and diesel driven generating sets and a dual air compressor set with swinging field dynamometer*



*The heat treatment shop, equipped with industrial scale plant, offers its services to local industry*

switchgear and d.c. motors. The X-ray laboratories house a 100 kV Metrovick unit for X-ray crystallography, a 100 kV Philips industrial X-ray set and a 300 kV Solus Schall constant potential set. These units, in addition to serving their normal purpose, provide excellent examples of remote control and protective circuits involving door and cubicle interlocks, oil, water and vacuum line switching, etc. These laboratories also house additional non-destructive apparatus, including gamma-ray equipment, supersonic testing apparatus, electronic and magnetic comparators, and magnetic and fluorescent crack detectors.

In the general physical metallurgy laboratories extensive use is made of Sunvic energy regulators and vacuum relays for furnace control, and also resistance proportioning controllers. Sunvic proportioning heads and electronic relays are used in both physical chemistry and metallurgical laboratories. Several potentiometers are available for precision thermocouple work with sensitivities better than one microvolt. Resistivities of metals and alloys are measured either by potentiometric methods or the Kelvin double bridge.

The general heating system is by means of hot-water radiators, but this is supplemented in the case of the metrology laboratory and the X-ray block by thermostatically controlled electric convector heaters. The internal telephone system was installed by Siemens Brothers & Co., Ltd., who were also responsible for the bell-ringing system and staff locator light and buzzer system.

We are grateful to the college authorities for permission to inspect the college and for help in the preparation of this article.

# Submarine Telephone Cables

*Modern Insulation Practice*

THE subject of this year's Llewelyn B. Atkinson memorial lecture to the Royal Society of Arts by Mr. J. N. Dean (Submarine Cables, Ltd.) was the insulation of underwater telephone cable. Gutta percha, which, he said, was first successfully used for submarine telegraph systems soon after 1850, was now used only for repairing existing cables. All new cables to-day were insulated with polyethylene, discovered in 1933 by Imperial Chemical Industries.

Polyethylene was superior to gutta percha mainly in the following ways: softening temperature above 212 deg F, whereas g.p. softened at air temperatures, varying with its type, that were often met in tropical climates or even in England; considerably less water absorption and diffusion, giving greater electrical stability; better dielectric properties, particularly at high electrical frequencies, i.e. speech frequencies and upwards; being chemically more inert, oxidation was more easily prevented by protection from light and/or by admixture of an anti-oxidant; greater hardness and strength; much cheaper; as a synthetic material its preparation could be closely controlled to impart the requisite qualities.

Adverse characteristics of polyethylene included microscopic surface ("environmental") cracking when in contact with many (usually polar) liquids, leading to brittleness when bent. This tendency became less at higher molecular weights when, however, viscosity was lower; the British method (exemplified by "Telcothene," proved in extensive service) of using a plasticizer, such as butyl rubber, seemed likely to become an international safeguard for eliminating this source of trouble.

Owing to the much higher melting point of polyethylene (compared with gutta percha) and the higher temperatures necessary for extrusion, the tendency to oxidize was increased, but by the use of an anti-oxidant, which did not harm its electrical characteristics, stability had been secured even at the 275 deg C requisite to extrude the hardest grades. Thousands of miles of cable were now giving satisfactory service on the sea-bed, without the need for preventing environmental cracking by separating the "Telcothene" insulation from contact with other substances, such as cable compounds.

Knuckling, which occurred when a broken weak conductor protruded through strong insulation (particularly if of straight polyethylene) and through the armouring wires, had rarely occurred in submarine cables. Tests in one instance (in 1948) revealed that when a cable was strained in laying or picking up, stretching of the copper core—through sliding inside the unwinding armouring—did not retract in relation to the insulation and armouring. Gutta percha being softer, less elastic and of low retractive strength, did not suffer in this way. Knuckling had now

been overcome by modifications in conductor design and in armouring. Particulars were given of the use of "Telecothene" cable in wartime installations and more recently in such instances as the 325 nautical miles of coaxial cable at carrier frequency between Weybourne and Denmark (1950) and the 300 miles between Aberdeen and Norway (1954). References were also made to the transatlantic telephone cable project (*Electrical Review*, 5th and 12th November and 3rd December) and to a recent development of an armourless cable, in which the tensile strength for withstanding the strain of laying was provided by the conductor instead of by the outer armouring wires. Such a cable, coupled with the use of relatively cheap and lightweight repeaters using transistors, was likely to open a completely new approach to the economics of telecommunication.

# Earthing Electrodes

## *Installation and Testing Practice at Collieries*

THE Production Department of the National Coal Board has recently circulated within its organization Information Bulletin No. 54/131, "The Installation and Testing of Earth Electrodes," in view of the fact that the installation and maintenance at the colliery surface of an efficient connection of the earthing system with the main body of earth is required by General Regulation 125 (a). Although no maximum value is laid down for the resistance of this connection, the figure of 2 ohms, mentioned in the Draft Regulations (1941), is generally accepted as reasonable and attainable. The Bulletin outlines the construction and lay-out of the principal types of earth electrodes and gives data relevant to them.

The coke electrode is the commonest type employed at collieries, and it has the advantages of very long life and ability to dissipate heavy fault currents. In a simple pit cast-iron pipes, 6 to 9ft long, are placed side by side standing upright upon the bed of coke, and the pit is then filled with coke breeze (well rammed) up to ground level. The top flanges of the pipes, projecting 1ft above the coke, are bonded together and the earthing conductors are attached to this bonding. Values normally accepted for the resistivity of various soils are given; e.g., clay and loam have a resistivity of 2,000 to 6,000 ohms per cu cm, while rock has a resistivity of up to 1,000,000 ohms per cu cm.

From the results obtained by the British Electrical and Allied Industries Research Association and other investigators, the resistance of a coke electrode is given approximately by the formula: $R^2 = \frac{144}{A}\left(\frac{\rho}{1{,}000}\right)$ where R is the total resistance of the electrode in ohms, $\rho$ is the resistivity of the soil in ohms/cu cm, and A is the total area of contact between coke and soil in square feet.

The use of copper or steel rods of 10ft or more in length, driven into the soil, has increased greatly of recent years and is now standard practice for power stations and sub-stations of the British Electricity Authority. Rods have the advantage of requiring no excavation and consequently are cheaper to install. They are, however, less permanent, being more susceptible to corrosion than the coke electrode, and are therefore less satisfactory for installation in made-up ground containing ashes. Where the subsoil consists of gravel or sand with a stratum of clay beneath it, it is an advantage to be able to drive rods through the upper layers into the region of lower resistivity.

The resistance of a single rod is given by the formula $R = \frac{\rho}{83L}\log\left(\frac{48L}{d}\right)$ where $\rho$ is the soil resistivity in ohms/cu cm, L is the length of rod in feet, and d is the diameter of rod in inches.

It will usually be found that the upper layers of the subsoil possess a higher resistivity than those lying beneath them. There are cases, however, where there is a shallow layer of subsoil over rock or sand, and in these circumstances it may be difficult to obtain the necessary low resistance with an electrode consisting of coke or rods. Bare copper strip or stranded copper conductors may then be laid in the ground at a depth of about 18in, either in one continuous length or in separate lengths radiating from a central earthing point. The resistance will then be obtained from the formulæ: Strip, $R = \frac{\rho}{250L}\log\left(\frac{216L^2}{wt}\right)$; stranded conductors, $R = \frac{\rho}{250L}\log\left(\frac{108L^2}{dt}\right)$; where $\rho$=resistivity of soil in ohms/cm, L = length of electrode in yards, t = depth buried, in feet, w = width of strip in inches and d = diameter of stranded conductor in inches.

The use of plates of cast iron or copper, buried directly in the ground, is rapidly dying out. A line of cast iron or steel piping, constantly full of water, may be used as a subsidiary earth, but never as the main earth electrode.

Every earth electrode is probably passing very small currents continuously into the surrounding soil, and electrolytic action will certainly take place if the soil conditions are appropriate. It is therefore important that the resistance of the earth electrode should be checked periodically. The simplest method of testing, where two or more separate electrodes are provided, is to isolate one electrode from the earthing system and connect a d.c. supply in series with an ammeter, between this and another electrode, so as to pass a current through the ground between them. The source of power should then be reversed and a second reading taken to eliminate stray earth currents due to polarization. A simple testing panel comprising an ammeter, a voltmeter and a d.p. reversing switch will enable the test to be carried out with the least delay.

An earth testing ohmmeter may be used to determine the resistivity of the soil. Four spikes are driven into the ground in a row, spaced x centimetres apart. The end spikes are connected to the "earth" and "current" terminals and the intermediate ones to the two "potential" terminals. The resistivity of the soil is then given by: $\rho = 2\pi x.R$ where $\rho$ is the resistivity of the soil in ohms/cu cm, x is the spacing of the spikes in cm, and R is the reading of the instrument in ohms.

## A.C. Commutator Motors

PUBLICATION No. G11010 by the British Thomson-Houston Co., Ltd. (a B.T.H. lecture-service publication), is entitled "The Variable-Speed A.C. Commutator Motor," by A. C. Lane, B.Sc.(Eng.), A.M.I.E.E. It contains an excellent exposition of the Schrage motor with a simple text and diagram step-by-step approach to the subject, rendering it particularly suitable for those engaged in lecture and tutorial work in universities and technical colleges. The evolutionary treatment of the subject is indicated by the sequence of sub-headings throughout the booklet: The magnetic field; a.c. generator; a.c. motor; induction motor; s.c. induction motor; s.r. motor; Schrage motor; and frequency convertor. The coloured circuitry of the diagrams makes a special appeal.

A copy free of charge and post free will be sent to any accredited lecturer who applies to the manager, Publicity Department, B.T.H. Co., Ltd., Rugby.

# GRAIN DRYING

## Automatic Humidity Control

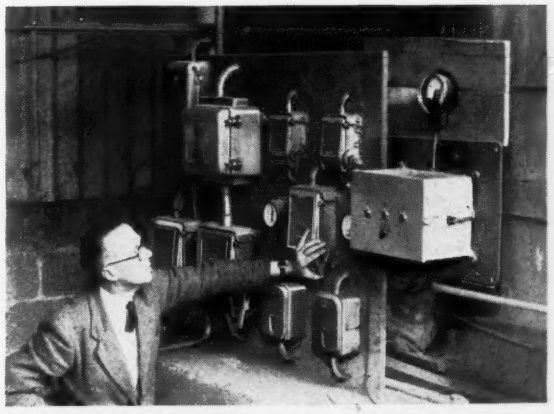
By E. C. CLAYDON, N.D.Agr.E.*

THE method of grain drying which employs ventilated silos has achieved considerable popularity in recent years, the number of grain dryers of this type now in use probably being more than that of all others. The first ventilated silo dryer in this country was built in 1948 at Pitstone, near Ivinghoe, Beds, and was described in the *Electrical Review* of 10th September, 1948, and 24th June, 1949, when details of operation and performance were given.

The principle of drying, which is that of continuous forced ventilation of grain in store by means of air at 65 per cent relative humidity, makes electricity particularly suitable for this kind of dryer which has to operate for days or even weeks with the minimum of attention. The use of heating is confined to that quantity necessary to reduce the humidity of atmospheric air from its normal 80–90 per cent to the 65 per cent necessary for the process. Since changes of humidity are relatively slow and precise control is not essential, hand switching was considered to be no great handicap. It was recognized from the outset, however, that automatic humidity control would be a desirable refinement and mention was made of the provision for its incorporation should this be found to be necessary.

Experience over several years in running ventilated silo dryers has confirmed the simplicity and suitability of hand switching so long as it is carried out by competent farmers with a knowledge of the principles involved in the drying process. The general introduction of these dryers, however, has inevitably produced conditions in which the more automatic the dryer can be made, the more certain will be its successful operation.

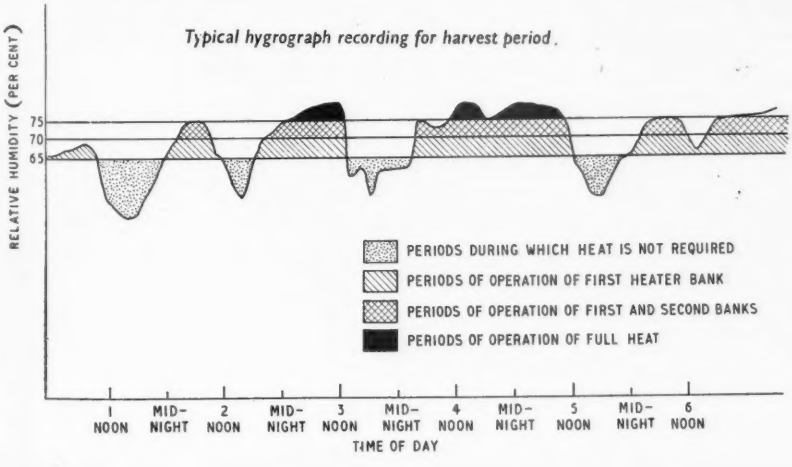
A triple contact Trambrecht hygrometer has recently been introduced by Opancol, Ltd., into this country and two trial installations have been put into operation at Buckhurst Farm, Withyham, and Place Farm, Firle, Sussex. The hygrometer is of the hair type provided with a stem which allows it to be fitted in the ventilating air duct if desired. It has actually been fitted in the open air at a position near the air intake in the installations mentioned. The instrument is set at 65, 70 and 75 per cent relative humidity and brings on heat in three stages according to the ambient conditions. A selector switch, on the mercury type contactor panel through which the hygrometer operates, can be set to manual or automatic control as desired. Pilot lamps indicate which of the heater banks are in operation.



*Automatic humidity control apparatus at Buckhurst Farm, Withyham*

The usual method of reading wet and dry bulb thermometers, calculating therefrom the relative humidity and applying the heat manually might well not be carried out correctly, particularly during the stress and strain of a difficult harvest.

A study of the hygrograph which was operating during the period of the trials reveals the conditions which make hand switching an irksome task. It will be observed that the periods during which the relative humidity falls below 65 per cent occur generally when the farmer may not be expected to be available. Four such periods occur during the six days shown in the diagram. The first is from 10 a.m. until midnight, the second from noon until 6 p.m., the third from 11 a.m. until 3 a.m. and the fourth from noon until midnight. It will also be noticed that full heat is seldom required, whereas the tendency when hand switching is employed is to use too much heat during damp periods. The controller ensures not only that no heat is used unnecessarily but that heat is always used when essential.




*Typical hygrograph recording for harvest period.*

* Agricultural engineer, East Sussex and South West Kent Sub-Area, South Eastern Electricity Board.

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# STEELMAKING

By J. F. SEWELL, M.Sc., F.I.M.*

THE use of electric furnaces for melting steel on a production basis really began during the first World War. Between the wars there was no great expansion of production facilities until just prior to the second World War. During and since that war expansion of production with some fluctuations has been continuous. The table shows the production of electrically melted steel as a percentage of total steel production in this country and in the United States of America.

**Percentage of Steel Production Electrically Melted**

| Year | U.K. | U.S.A. |
|---|---|---|
| | % | % |
| 1920 | 1·0 | 1·5 |
| 1930 | 1·0 | 2·0 |
| 1940 | 3·4 | 2·5 |
| 1941 | 4·7 | 3·5 |
| 1942 | 6·6 | 4·6 |
| 1943 | 7·6 | 5·2 |
| 1944 | 6·7 | 4·7 |
| 1945 | 4·6 | 4·3 |
| 1946 | 3·8 | 3·8 |
| 1947 | 4·5 | 4·5 |
| 1948 | 4·8 | 5·7 |
| 1949 | 4·8 | 4·8 |
| 1950 | 4·5 | 6·2 |
| 1951 | 5·3 | 6·7 |
| 1952 | 5·7 | 7·3 |

The main point of interest during the last few years has been the development in the United States of the large arc furnace for steel melting. Before this practically all electric melting furnaces had a very much smaller capacity than the general run of open hearth furnaces. Electricity as a source of heat has always been more expensive than the conventional gaseous or liquid fuels used for heating other steel furnaces and consequently compared with them the electric melting furnaces have always been at an economic disadvantage. They have thus had to rely on other advantages for their development. That these advantages exist is amply proved by the figures quoted above.

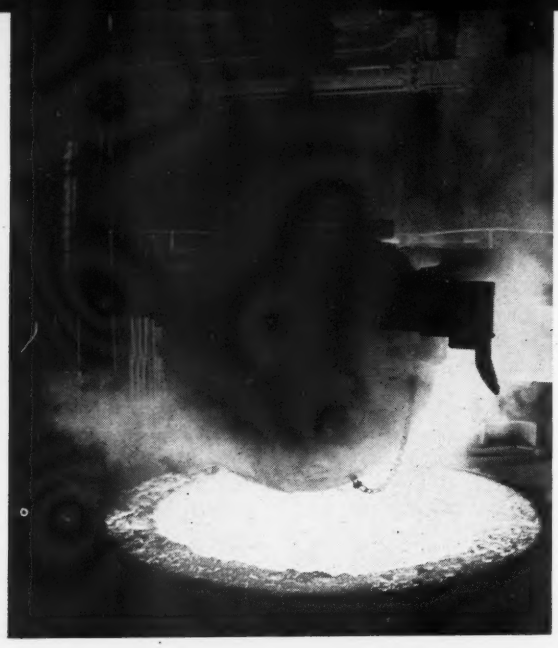
## Types of Electric Furnace

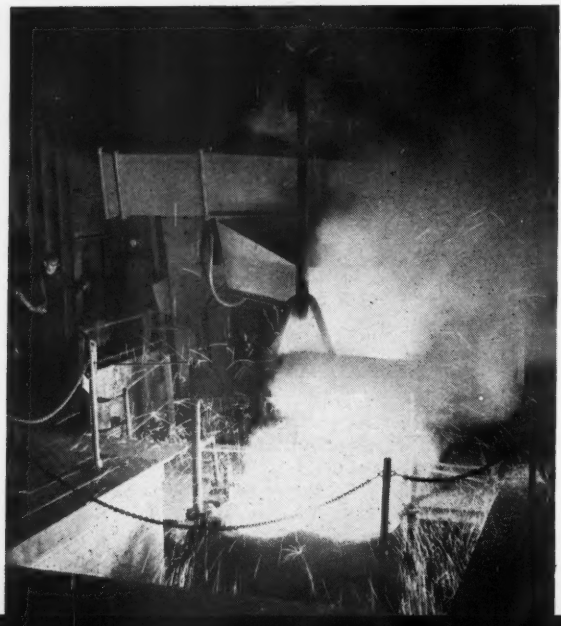
Of the two types of electric melting furnaces responsible for the bulk of production, the electric arc furnace is of the greater importance. Substantial quantities of steel are melted in high frequency induction furnaces, but these steels are mainly for special applications where the furnace is peculiarly suitable. It has some particular advantage of its own, but in general it has not the wide range of advantages that can be found in the arc furnace. Consequently the electric arc furnace has become the main unit for the production of electrically melted steels.

Both types of furnace can be lined with either acid or basic refractories; in the case of the high frequency furnace the type of lining depends more upon the type of steel being made than in the arc furnace where the purpose for which the steel is required is the governing factor. The acid lined arc furnace is used for straightforward melting procedures as required in foundries, whereas the basic furnace excels where special refining has to be done, as in the special ingot field.

In all gaseous or liquid fuels for heating steel furnaces there are present, to a greater or less extent, elements, such as sulphur, which are harmful in the resulting steel. By the use of electricity the charge can be heated and melted rapidly without any such contamination.

*Samuel Fox & Co., Ltd., associated with United Steel Companies, Ltd.





*Top : Top charging of basic electric arc furnace*
*Centre : Tapping a 2 ton high frequency electric furnace*
*Bottom : Tapping a 12 ton basic electric arc furnace*

# METALLURGICAL FACTORS IN THE DEVELOPMENT OF ELECTRIC FURNACES

Since electricity as a source of heat can be so readily controlled, electric furnaces can be operated nearer to the critical temperatures for the refractories with relatively little risk of damaging them through unforeseen temperature fluctuations. The control of heat input to the furnace enables the reactions taking place to be more readily controlled than in other melting units and enables the optimum temperatures for each stage of the process to be more easily obtained.

In the making of alloy steels some valuable elements such as manganese and chromium, which are often in the scrap charged, are readily oxidized and so are easily lost from the metal to the slag. This oxidation can be more readily controlled in the electric arc furnace than in other types of furnace, so that other elements such as carbon and phosphorus which one may want to remove can be oxidized preferentially with a more limited loss of the elements manganese and chromium.

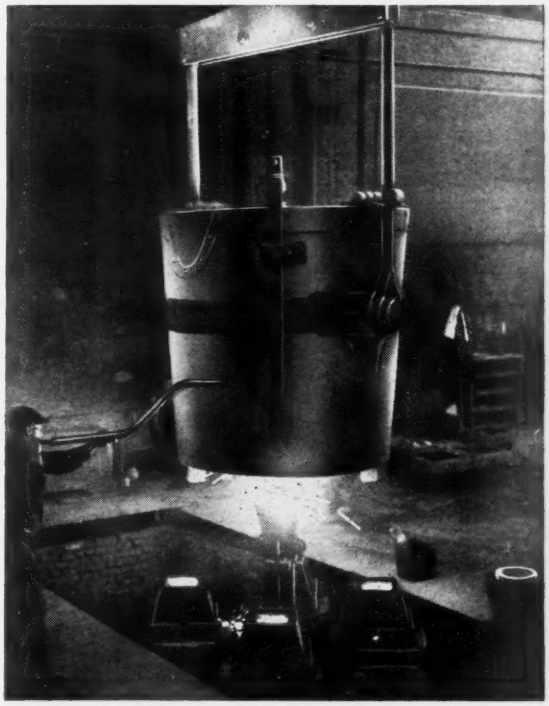
Furthermore, it is possible to reduce these metals back from the slag once the desired carbon level is reached, providing the return of phosphorus, which would also take place, would not be too undesirable. If the phosphorus content of the original charge is high it can only be removed from the sphere of operations by removal of the slag after the oxidation period. In this event the oxidized manganese and chromium are also lost.

## Advantages of Basic Furnace

The basic electric arc furnace has, in addition, the advantages of: (1) Versatility, in that practically all known grades of steel can be made by this method, and at the same time the process is less critical as to raw materials (100 per cent scrap charges are common practice). (2) Owing to the small slag volume compared to the open hearth furnace, adjustments to affect its type can easily be made and equilibrium between it and the metal more quickly obtained. (3) Since it is possible to exclude excess air from the arc furnace, conditions can be controlled to permit the steel being treated under either oxidizing, reducing or neutral slags, and since the furnaces are invariably provided with facilities to assist the removal of slag it is possible to treat the steel with any combination or succession of these slags. (4) The ability to treat the steel under a reducing slag assists in the removal of the inclusion-forming oxides from the metal before the final deoxidizing additions. Consequently smaller final additions need to be made than in other steelmaking practices and the resultant steel has less inclusions.

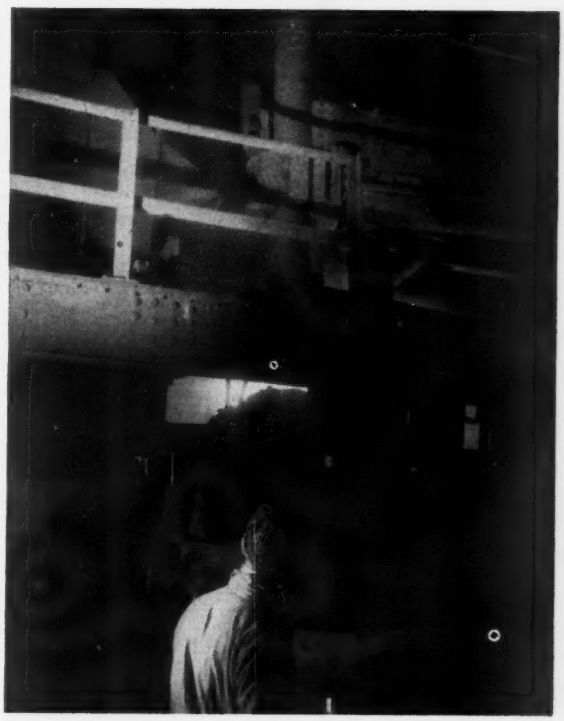
Features peculiar to the high frequency induction furnace as a means of steel melting are that: (1) The charge can be melted without any danger of carbon pickup as may occur from the electrodes in the arc furnace. (2) The stirring resulting from the motor action of the induced current is useful in promoting uniformity in the melt. (3) This furnace offers many advantages for the vacuum melting of metals, a process still in its infancy; and (4) when steels of very low carbon content are required, such as in high permeability magnetic irons and alloys and certain alloy and stainless steels, pre-melting of selected base materials gives results which are unobtainable by other processes.

This furnace lacks the versatility of the arc furnace in that operation with multiple slags is difficult and so the furnace is normally operated as a purely melting unit, and as such has largely replaced the old crucible furnace. As a simple melting unit the finished product is mainly



*Teeming of molten steel tapped from an arc furnace into ingot moulds*

*The photograph below shows the electrodes at the top of a 12 ton basic electric arc furnace*



controlled through the charge so that a precise knowledge of the chemical composition of what goes in is necessary.

The advantages of the electric method of melting steel will be discussed in greater detail later, but from the broad outline given it will be seen that they have resulted in the development of this type of melting for the higher grades of steels. Owing to the constant efforts to increase strength/weight ratios of materials of construction in modern equipment, steel requirements are steadily becoming more rigid. The more exacting the requirements become, the easier it is for electric steel to compete with other steelmaking processes where greater difficulties are experienced in meeting specifications.

For a large number of so-called special steels including tool steels—heat resistant and corrosion resistant steels, steels for ball and roller bearings, steels for some kinds of ordnance and for aircraft construction and many others—where a high degree of uniformity in composition and structure with an almost complete absence of certain inclusions and harmful defects is desired, the quality of the arc furnace steel more than compensates for its economic disadvantage. It is this quality advantage which gave the great impetus to electric steel production during the war years.

## The Basic Arc Process

Production of steel in the basic electric arc furnace can be accomplished by one of several procedures which can be classified into three main types: (1) Melting a cold charge and processing under an oxidizing slag in much the same way as in the open hearth furnace. This method is most usual for common steels. (2) Melting a cold charge and processing under an oxidizing slag, after which the slag is replaced by one of a reducing nature and the cast refined under these conditions. (3) The use of a hot metal charge with either of the preceding processes.

The first method has been practised on occasions in this country and is the basis of the latest development in the use of large furnaces in the United States. The process is based on the lower capital costs for the installation of an electric furnace plant, the availability of cheap scrap and the ability of the electric furnace to melt 100 per cent scrap charges without being too particular as to the grade of scrap. A higher metallic yield, amounting to about 2 per cent, is obtained than by open hearth melting. Further, consumption of refractories is much lower in the arc furnace than in the open hearth and when replacements and renewals do become necessary they can be accomplished very much more rapidly. Plant is thus out of commission less frequently and for much shorter periods.

Using large furnaces of about 100 ton capacity and operating on cold charges the electric arc furnace will out-produce substantially an equivalent sized open hearth furnace, and thus is succeeding in matching the costs of open hearth steel production in the United States.

In the study reported recently by the Battelle Memorial Institute of the comparative economics of open hearth and electric furnace production of low carbon steel it was found difficult to give due credit for the less tangible performance factors in arc furnace practice such as flexibility, ease of control, availability, steel quality and working conditions.

Since the cost of electric power supplied by coal burning power stations in the United States is comparable with the cost of electric power in this country, while on the other hand open hearth fuel costs in the United States, especially where oil is used, are less than in this country, the use of this method may develop here. So far our experience has been confined to smaller units of up to 30 ton capacity, but the first large arc furnace, twice this maximum size, is now in production.

The second method of steelmaking, the double slag process, is the most familiar in this country and is the one by which the majority of the high grade steels are made. It is on steels made by this process that most claims of the superior properties obtainable from electric steels are based.

From the economic point of view the fact that most electric arc furnaces have removable roofs and can thus be top charged, thereby cutting charging times very materially as compared with open hearth furnaces, is a great advantage. Because of the ability of the electric arc process to recover large quantities of alloys from the scrap, proper scrap segregation is of the utmost importance if the greatest benefits are to be derived from the process and also to avoid contamination of the steel with unwanted alloys.

In melting the charge, the electrodes first cause a small area directly underneath them to melt, and the hot molten metal forms a pool in the hearth. At this stage it is possible to increase the voltage and so the length of arc to accelerate the melting, while at the same time the pool of metal helps to melt what is left of the charge from the bottom up. Throughout, there is never any contact with products of combustion of a fuel, or of its contained contaminants. Carbon from the electrodes is the only foreign material, apart from the furnace lining and slag, which comes into contact with the metal.

## Carbon-Oxygen Reaction

While numerous chemical reactions can, and do, take place in any steelmaking process, it is generally conceded that the carbon-oxygen reaction is the basic one. Carbon is the element that distinguishes steel from commercial iron and it is the principle element controlling properties. The main objective of the carbon-oxygen reaction is to oxidize excess carbon from the charge, but the value of the accompanying boil should not be under-rated. The agitation, stirring, and mixing result in even distribution of the heat and promote uniformity of composition. The open hearth operation with the bath heated from above by radiation would be impracticable without the carbon boil. The electric arc furnace is somewhat less dependent upon it, but every melter knows how much easier it is to gain heat with minimum damage to refractories during the boil than with a dead bath. It is recognized and admitted that much of the mechanics of high temperature reactions is imperfectly understood and sometimes completely unknown. However, in a steel bath on a carbon boil the carbon oxidation regulates directly the state of oxidation of the metal and indirectly that of the slag, whether the bath is in an acid or basic open hearth or electric arc furnace. This simplifies the control problem in all these cases to that of maintaining a steady boil with control of both temperature and carbon content as the main variables. In the acid process these variables also control the slag composition in all important respects and in the basic process they leave only the slag basicity as the remaining fundamental control factor. Thus the readier control of heat input and temperature in the arc furnace gives greater overall control during the oxidizing stage.

When the desired carbon level is reached the carbon boil is checked in the basic open hearth furnace by deoxidizing the charge with spiegel or ferro silicon and, providing there is adequate slag basicity, no phosphorus reverts to the metal. By such blocking of the charge, though only temporary in its effect, the carbon can be held constant and, to some extent, even the more readily oxidized alloys such as manganese and chromium. In

the electric arc furnace the slag is first removed and the preliminary deoxidation with ferro silicon done on the bare metal, and then the process is completed by the substitution of a reducing slag for the oxidizing one. This is one feature peculiar to the basic electric arc furnace which makes the process so attractive. Under these reducing conditions in the arc furnace sulphur removal, a difficult operation by other steelmaking processes, can be achieved readily by suitable adjustments to the slag.

The fact that the oxygen content of the metal can be reduced by suitable manipulation of the slag is no doubt a material factor in the production of relatively clean steels from the electric arc furnace. In the case of other steelmaking processes any excess oxygen in the metal is taken care of in the final stage of the steelmaking by deoxidizers such as ferro silicon, silico-manganese, aluminium, etc., which in themselves have a greater affinity for oxygen than iron has. The products of the reaction are oxides or silicates often of complex types which are generated throughout the mass of metal. Even though these may tend to coagulate and rise in the metal and pass to the slag, the process is never sufficiently complete for these inclusions to be eliminated entirely from the metal during the short finishing operations.

In the case of the arc furnace, the reducing nature of the second slag exerts a reducing action on the iron oxide throughout the whole of the reducing period. More time is thus available for coagulation and separation of the products, and consequently substantial quantities pass to the slag. In the finishing stages of the heat, since there is a lower oxygen content in the metal, less deoxidants are required and thus less inclusions are formed to be trapped when the metal solidifies.

It is, of course, the ability to maintain reducing conditions in the furnace that makes possible the higher recovery of oxidizable metals than in the open hearth furnace. In open hearth practice, and to a less extent in electric arc practice, operating under a single slag, metals such as manganese, chromium and vanadium if present or added to the charge are readily oxidized and pass to the slag. But once reducing conditions are obtained, as in the double slag process, in the basic electric arc furnace these metals can be safely added and retained. Even if such metals are oxidized before reducing conditions are obtained it is possible to reduce them back to the metal at a later stage. As a result most very highly alloyed steels are made in electric furnaces, since alloy loss and often alloy recovery from highly alloyed scraps become vital factors.

## Magnetic Stirrers

There are perhaps one or two disadvantages in the use of a second slag and reducing conditions, but we are still in the early stages of learning about these. Under the reducing slag the carbon boil stops and its stirring effect disappears so that the bath remains quiet and only slow thermal effects help towards consistency. Thus the rate of reaction between slag and metal becomes very slow. In an effort to overcome this, magnetic stirrers have been devised, but practical experience with them is still very limited. The claims made are that the stirring action not only promotes greater uniformity, but that with stirring it is possible to get a quicker and more complete removal of sulphur under the reducing slag. The second major problem is that under reducing conditions, some gases, notably hydrogen, are more readily absorbed by the metal so that the longer the steel is held under these conditions the greater probability there is of increase in gas content. The full effect on the properties of the steel of these gas contents is by no means fully understood, although in the case of hydrogen one of the widely accepted theories is that this gas is responsible for hair lines or " snow flakes " in the steel.

Finally, since control of heat and conditions is so readily maintained in the arc furnace it is extremely easy to repeat any cycle which has once been established as the most desirable. Reproducibility in any process, especially a heat process, tends to improve the quality of the product.

## Properties of Electric Steel

It has been emphasized that the development of electric furnaces for the production of steel has been largely the result of the demand for improved qualities in the steel, and consequently the widest application of the process has been in the production of material for the most highly stressed components. The practical means by which these improvements have been obtained have been described, but it seems that some explanation of the manner in which the properties of electric steel appear to be superior to open hearth would not be out of place before concluding.

Steel specifications (apart from special easy machining steels) may permit sulphur contents up to ·060 per cent. High percentages of sulphur in steel are detrimental since they may produce what is known as hot shortness, i.e. tendency to be brittle during hot working. Secondly the sulphur which is soluble in the liquid steel separates after solidification as inclusions usually of manganese sulphide. As the higher grade raw materials become exhausted and the steel industry has to rely more and more upon irons, scrap steels and fuels with higher sulphur contents, methods for its removal become increasingly important.

Inclusions in steel in general are objectionable. An inclusion on a polished surface is unsightly in appearance and may form a nucleus to initiate corrosion. In shafts inclusions may cause excessive wear on a bearing or result in a concentration of stress due to notch effect. The notch effect resulting from an inclusion might be sufficient to cause rejection during processing, promote cracks from stresses during heat-treatment or cause failure in service. Inclusions on the other hand can be used to confer particular properties such as the use of sulphur to promote better machinability in steel. All steels contain some inclusions, but the lower their content can be made the less the probability of detrimental effects.

As far as conventional static and dynamic properties are concerned—tensile and yield strengths, elongation, reduction of area, and endurance limit—it is impossible, at least with our present knowledge, to say that electric furnace steel is better than open hearth steel, if of comparable composition and grain size. There is an exception to this, however, which might have been mentioned in dealing with cleanness, in that certain types of inclusions give rise to low strength and ductility in the transverse direction. For example, it has long been the experience of the principal ordnance manufacturers that gun steels which must have high transverse elongation, reduction of area and impact resistance could be made from forgings of electric furnace steel, whereas rejections were high if similar forgings were made from open hearth steel. Electric steel is often used where particularly high impact properties are required, but any advantage here may well be due to the greater cleanness of the steel or to finer grain size.

The use of electric furnace steels in the highly stressed parts of aircraft have developed in a similar manner and the introduction of stricter testing techniques, such as the magnetic particle test, have also revealed the greater ability of electric furnace steels to meet specifications. The more restrictive the requirements become the easier it is for the electric steel to overcome its present economic disadvantage compared with other steelmaking processes.

# Engineering in Europe

*Abstracts from Foreign Technical Journals*

POLARIZED relays have many valuable characteristics such as high sensitivity, directional action and short response time which explain their wide use in telecommunications and progressing introduction in other fields, viz. automatic power system control and protection, tele-control, process control, etc. Yet an uncritical transfer of design principles, however well proven in one field, to another where conditions and requirements may be similar to a certain extent, but hardly ever identical, cannot yield optimum results. Designers often fail to make sure how far this similarity goes and adapt their new types to changed conditions simply by increasing sizes, etc. This is partly due to the fact that these relays were more or less developed on an empirical basis and that this proved to be good enough for the communication types.

The author shows that a theoretically correct design may be based on a minimum of mathematical apparatus, but that it is necessary to distinguish between the various magnet systems (single-coil, two coils with or without magnetic coupling), according to kind, size and travel of the armature, to consider the kind of operation required (single or dual-position relay) and whether the response of the relay is obtained by magnetic attraction only, or by combined effect of magnet and springs (the latter enables the air gap to be reduced). In certain cases it is necessary to determine the resetting coefficients, particularly where residual unbalance currents must be expected. An appendix summarizes all the formulæ required which may also serve for checking the design parameters of existing relays.—"Problems of Designing Polarized Relays for the Automatic Control of H.V. Installation," F. A. Stupel, *Elektrichestvo*, No. 7, pp. 43–46, 1954, in Russian.

## Conductive Rubber

The production of conductive rubber is based on the use of a special kind of "active" soot as a compounding material, since only this kind of particularly fine soot particles forms a conducting lattice or skeleton inside the rubber mixture. However, not every kind of "active" soot is suitable for the purpose; best results are obtained with acetylene soot. A continuous graduation from resistivity values of the order $10^{12}$ ohm-cm down to a few ohm-cm is possible by judicious compounding, this corresponding to a very wide range of heterogeneous and specialized applications.

It is obvious that not only electrical, but also varying mechanical, thermal and chemical requirements have to be satisfied in every special case, a complex problem that as often as not may have to be solved by compromises between incompatible, or unachievable, optimum characteristics in different respects. Among the particularly interesting applications of conductive rubber is its use for dielectric "soldering" of insulating rubber to metal and protection of the former against deterioration and cracking under the influence of ozone-filled interstices between metal conductors and insulation ("Ozonex" principle). It is also used for replacing metal sheaths of h.v. cables where particularly high flexibility of the latter is required.

Another special use in cable manufacture concerns the case of mining cables with pilot wire. The applications mentioned so far refer to uses as a "grading" intermediary between conductors and insulators proper, but there are many other uses as resistance material, e.g. as damping resistances and connections to measuring instruments in v.h.v. plants, heating elements in heating blankets, mats and tissues (in the last case not all the technical difficulties have been overcome yet).—"Conducting Rubber in Electrical Engineering," E. Bormann, *VDE-Fachberichte*, Vol. 17, pp. 37–43/I, 1953, in German.

## Insulant Heat Resistance

Nitrogen-ageing of insulating materials shows that only absolute exclusion of oxygen can suppress the ageing phenomena caused by oxygen. Also, an accumulation of products of decomposition must be prevented. Critical decomposition temperatures under long-time service conditions are given for 80 insulating and plastic materials and compared with temperature limits valid for 3–90 day temperature rises. The measured values are generally confirmed by mechanical and electrical test results. The reduction of the heat resistance with ageing period is considerable.

Apart from carbon fluorides and silicones there are hardly any organic materials with a critical decomposition temperature above 120 deg C. The law of the service life was found confirmed. The testing method used permits comparisons of the temperature resistances of various materials and also reveals certain details of the ageing processes. It is more generally applicable than other methods. In general, two to three months' ageing time will be sufficient. The relation between the critical decomposition temperatures and long-time heat resistance has not been clarified yet. The problem of finding the limiting temperature in long-time service by accelerated ageing tests is not likely to be solvable by a single testing method, although the method discussed may be an important contribution to the solution of this problem.—"Heat Resistance of Insulating Materials," G. Ehlers, *E.T.Z. (A)*, Vol. 75, No. 14, pp. 469–476, 11th July, 1954, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

# Progress of Brazilian Electrification

*From Our Rio de Janeiro Correspondent*

THE new Nilo Peçanha station of the Light & Power Co., at Ribeirao das Lajes, Rio, formerly known as Forçacava, with a capacity of 330,000 kW has been completed. Construction work is now starting on the Cachoeira Dourada station (180,000 kW), in Goias, and on the Jurum-Mirim station (130,000 kW), the first of a series of three to be built on the Paranapanema River, in Minas Geraes, with a combined capacity of 449,000 kW. The 4,600 metre tunnel, conveying water from the Guanhaes River to the station of 154,000 h.p. at Salto Grande de Santo Antonio, in Minas Geraes, has been completed. The station should begin operating by the end of the year. Another project has been approved for a 300,000 h.p. hydro-electric station at Peixotos, in Southern Minas Geraes.

The National Bank for Economic Development has advanced the equivalent of £4,480,000 to the State of Bahia to build the central hydro-electric station at Funil. Two private supply companies in Ceara and Goias have received loans to amplify their installations.

# Trade Discounts

## *Ensuring Their Retention in the Proper Hands*

By E. A. FOWLER, M.I.E.E., F.I.E.S.*

UPON the occasion of the twenty-first anniversary of the establishment of the Electrical Fair Trading Council I am sure that everyone associated with the electrical industry will congratulate the Council on its achievement over this period in the pursuance of the policy of fair trading. Having regard to the enormous growth of the electrical industry during the past 50 or 60 years, and the relatively orderly business conduct of the many manufacturers and traders operating throughout the country to-day, the sound principles and work of the Council in maintaining a Fair Trading Policy are abundantly evident. I am convinced that a return to more normal times and with fierce competition perhaps not far away, the recognized principles of Fair Trading Policy evolved over the past 21 years of experience are a useful reminder to us all at this time.

*Mr. E. A. Fowler*

The principles which have been embodied in the Fair Trading Policy for the home trade may be summarized as follows:—

> "The regulation of business between all sections of the electrical industry so as to ensure that the function of each is defined and understood, and that each receives the fruit of its labour to the end that equity and fair dealing prevail throughout the industry, that the public be well served and the cause of electricity advanced."†

a remarkably clear and well-defined expression of policy—a statement well worthy of repetition—covering as it does the business activity of all the sections of the electrical industry.

Where the manufacturers of goods of like classes subscribe to a fair trading policy based on agreed discounts, it surely means that the list prices of the goods are a fair reflection of their real value. This is an advantage, not only to the trader but to the retail customer.

### Quantity Terms

A possible criticism lies in the thought that because of the generosity of the basic trade discount, manufacturers have insufficient scope to exercise their discretion as to additional discounts for large quantity buying. This discourages buyers from placing large orders, and tends to cause them to use their suppliers as "warehousemen," which results in the more frequent placing of small orders, with consequent heavy administrative costs on both sides.

A lower basic discount with graded quantity terms would tend to overcome this. The legitimate electrical retailer is disheartened at the ease with which "casual" traders appear to be able to obtain the full trade discount, and we have all seen evidence at some time or another of the small grocer's shop, cycle dealer or garage, who seem to be able to obtain and retail a variety of electrical goods. This tendency for all and sundry trades to "break in" on legitimate electrical business and to secure the same margin of discount is a growing practice which should be checked without delay.

Then there is the large class of "user" buyer, often very small factories who may employ only one electrician/odd-job man, who appear to be able to obtain supplies on trade terms. It would seem that this aspect of the position also requires a certain tightening up.

The essence of a fair trading policy is that it should be practised by the majority of, if not all traders. Unfortunately, there are still plenty of unregistered electrical contractors, many without proper selling organizations, who are able to obtain full discount from the suppliers and are prepared to "split" it with their customers. If discounts were more closely related to quantity, this tendency would be curtailed naturally.

Again, co-operative stores paying dividends on electrical purchases have found another way of avoiding the maintenance of list prices. These suggestions, although perhaps outspoken, are intended to promote thoughtful interest in the problems which must be faced in the future trading activity of this progressive industry if fair trading principles are to be maintained.

### After-Sales Service

Recent alterations which the Council have introduced define more clearly the "electrical contractor" and the "electrical retailer," and this tightening up should more effectively control the casual dealer who merely wishes to "cash in" on a selling activity without giving the public the continued service after sales which is so essential if the prolonged interest of the consumer is to be served.

Mention of the word "service" brings to mind very forcibly the problems with which the industry will be faced with increasing intensity. Notwithstanding the plant shortage difficulties which the electricity supply industry had to overcome and which prevented promotional sales activity in the immediate post-war years—a situation which we hope is now largely behind us—the impact of sales in every section of the electrical industry has far exceeded all expectations, and fortunately shows no sign at present of receding.

It must not be overlooked, however, that many consumers or customers are experiencing the large-scale use of electrical appliances for the first time and they will expect long life from their equipment and prompt repair service and general maintenance at low cost if they are to be encouraged to continue "the electrical way of life." Also, there is the responsibility of the industry to ensure that all repairs and appliances are carried out so as to ensure safety and in compliance with the Electricity Regulations. For these two reasons alone, the Council is justified in its closer definition of the contractor and the retailer, to ensure that these important features are adequately catered for and the public assured of complete satisfaction for the present and future.

The Electricity Boards, too, maintain a responsible position in the general trading scheme, and during the six years of trading as a nationalized industry there has been ample evidence of the desire on their part to closely

* Chief Commercial Officer, Eastern Electricity Board.

† Fair Trading Council Booklet, page 3.

observe the principles of fair trading. I am sure that the commercial interests of the Area Boards are as keen as any other private trader to ensure the maintenance of a fair trading policy and a justifiable discount structure within the electrical industry. Good sales and service facilities for consumers has been continued at all of the Boards' service centres throughout the country and every effort has been made to increase the saturation ratio of electric cookers, water heating and off-peak thermal storage heating, so vital to the economy of the industry. The Fair Trading Council has shown great courage and fortitude over the past 21 years in pursuing the principles of a sound fair trading policy in the electrical industry; may it enjoy continued success in the future.

The author wishes to thank the chairman of the Eastern Electricity Board for permission to publish this article. The views expressed are those of the author and not necessarily those of the Board.

# News from India

*From Our Bombay Correspondent*

THE National Development Council, an official body which looks after the general planning and initiation of industries sanctioned by the Planning Commission, has decided that industrial projects have been lagging behind the power projects. This may have been partly due to a lack of sufficient capital in the country and partly to paucity of qualified technical consultants with the necessary experience. The second Five-year Plan, details of which are now being worked out, is expected to stress the development of manufacturing industries such as construction machinery, cotton textile, jute, paper, cement, chemicals, printing and mining, and the plant used in manufacture. Other industries listed for study include ferro-alloys, marine diesel engines, locomotives, generators, X-ray medical equipment, heavy chemicals and fertilizers.

The capital for these industries will be forthcoming from the Government through the Industrial Development Corporation, an official body, and through the newly set up Industrial Credit and Investment Corporation of India, a private body formed with the assistance of the World Bank and the Government. It has been decided to secure technical advice from a nucleus of three or four general engineers who will assist in selecting suitable consulting and design engineers for investigation of specific projects. A firm of consulting engineers of international standing is also to be invited to open an office in India.

The Industrial Credit and Investment Corporation which was set up on 15th November has an initial capital of about £14 million of which the Government will provide about £6 million and another £4 million is expected to be raised through Indian, British and American shareholders. The Government loan will be repaid in fifteen years and after that the Corporation would be entirely a private body. Dr. Mudaliar, the chairman of the Corporation, said recently that it would take a direct interest in securing technical advice and getting experts, foreign and Indian, to examine the concerns applying for loans. The World Bank will supply the rest of the capital.

## Steel Plant Offers

A technical mission of Soviet steel experts arrived in India in November for discussions with the Ministry of Production in connection with the Soviet Government's offer to set up a steel plant in India with Russian capital, materials and machinery. The offer was made directly to the Government of India and not much is known about it except that the capacity would be in the region of a million tons a year and the total investment near the £75 million mark. There are political difficulties involved but if the deal goes through the plant will probably be situated somewhere near the Orissa-Madhya Pradesh border.

The Soviet offer is the first major proposal for Russian capital investment ever to be made to a non-Communist country, and the Commerce Minister has said that he would rather have it routed through one of the United Nations agencies than have it accepted directly. An officially sponsored mission of Indian industrialists has recently returned from a tour of the Soviet Union and Eastern European countries and although it has still to submit its report, the leader has been reported to have declared that "there was little possibility of any large-scale assistance or trade from these countries." Coming on the eve of the arrival of the Soviet steel experts, the statement is considered significant in quarters interested in the British offer mentioned below.

This offer was the fourth to be made so far, the others being from Germany, Britain and Japan. The German proposal has already been accepted and work has begun at Rourkella, in Orissa, where Krupp-Demag will help the Government of India to set up a plant with an initial capacity of half a million tons to be increased progressively to a million before 1961. The German combine is investing about £10 million; the rest will come from the Government.

The British offer, which was made privately to the firm of Birlas, is considered quite attractive from the Indian point of view, its principal features being that the plant would go into production within three years and the entire machinery, representing 60 per cent of the capital investment, would be supplied by British steel manufacturing organizations. The total investment, which would be about £50 million for a 675,000 ton annual output or about £70 million for a million tons, would be repaid in instalments spread over ten years and would probably bear interest at 4 per cent. Indian industrialists would also participate in the project which would be financed by the Government to the extent of £12 million initially. British technical experts are expected in India soon for preliminary discussions.

The Japanese offer was made before the German offer was accepted and is not considered a serious proposition.

## Bombay Oil Refinery

The first of three oil refineries scheduled for completion under the Five-year Plan was inaugurated by the Union Production Minister in November, when the Standard-Vacuum Company's £15 million refinery went into production at Trombay, an island about 20 miles from Bombay. The refinery, with a capacity of 25,000 barrels a day, will normally turn out more than 300 million gallons of six different fuel products a year. The capital expenditure so far has been about £15 million and it is expected that the installation, which has increased the country's refining capacity fivefold, will save the Exchequer about £900,000 a year, besides reducing fuel oil imports by 32 per cent.

The refinery was built by the company's own experts but most of the civil engineering and building work was entrusted to Indian contractors. The main electrical contract went to the English Electric Co., which supplied and installed all the transformers together with the h.v. and l.v. switchgear. There are three main h.v. substations (22/3·3 kV) and seven unit substations for 415 V supply, the former having two transformers of 5,000 kVA, one of 3,000 kVA and two of 1,500 kVA, and the latter step-down transformers having capacities varying from 750 kVA to 50 kVA. The main supply for the refinery is now received from the main grid but a new 100 MW thermal station which the Tata Co. is building nearby is being specially designed to cater for the refinery loads and, if possible, to utilize their waste gases as fuel.

# Indian Electrical Manufacture

## *Production of Transformers and Motors*

**By an Indian Correspondent**

IF all goes well with India's power projects now under way all over the country, they will have, by 1956, raised the total installed capacity from just under 1·4 million kW in 1948 to about 2·8 million. This sizable increase has its own problems of absorption but the Planning Commission is confident that the difficulties, if any, will only be temporary. This is reflected in the importance which the Commission has given to the electrical industries in its plan and in its aim to make the country as self-sufficient as possible in such items as motors and transformers. Considering that neither transformers nor motors were being manufactured in India on any appreciable scale before the last war, the confidence with which the industry is planning its expansion deserves attention. By 1956, the final year of the Five-year Plan, the industry is expected to increase its annual production of transformers from the present 280,000 kVA to 450,000 kVA per annum, and of motors from 141,000 h.p. in 1951 to 320,000 h.p.

**TRANSFORMER PRODUCTION IN INDIA**

| Class | 1949 | | 1950 | | 1951 | |
|---|---|---|---|---|---|---|
| | No. | kVA | No. | kVA | No. | kVA |
| Up to 3·3 kV .. | 169 | 15,831 | 268 | 17,301 | 313 | 23,300 |
| Between 3·3 & 6·6 kV | 117 | 21,271 | 167 | 43,460 | 252 | 53,791 |
| Between 6·6 and 11 kV .. .. | 588 | 38,190 | 793 | 86,035 | 1,317 | 95,473 |
| 22 kV | | | | | | |
| Up to 25 kVA .. | 7 | 175 | 10 | 250 | — | — |
| 25–75 kVA .. | 76 | 4,725 | 20 | 1,185 | 10 | 500 |
| 75–250 kVA .. | 22 | 2,650 | 15 | 1,700 | 20 | 2,350 |
| 250–500 kVA .. | 2 | 1,000 | 1 | 500 | 7 | 2,900 |
| 500–1,000 kVA .. | 1 | 1,000 | 3 | 2,750 | 4 | 3,100 |
| 1,000–1,500 kVA .. | — | — | — | — | 1 | 1,250 |
| 33 kV | | | | | | |
| 75–250 kVA .. | — | — | — | — | 2 | 500 |
| Total .. .. | 982 | 84,842 | 1,277 | 153,181 | 1,926 | 183,164 |

There are at present seven works with a rated capacity of 370,000 kVA per year engaged in the manufacture of transformers of various types and sizes, the industry being predominantly concentrated in Bombay, with just over a half of the national capacity, followed closely by Calcutta where there are two units with a capacity of just over 100,000 kVA. The types being manufactured are of a comparatively low rating, viz., 1,000 kVA and 22 kV on the high-voltage side although recently the range has been extended to 2,500 kVA and 33 kV. The actual production, however, lags far behind the installed capacity, but is showing a steady increase as indicated in the table above.*

* In 1952, 214,800 power transformers were manufactured, the figure for 1953 being roughly 280,000 units on the basis of an average monthly production of just under 24,000 maintained up to August, the last month for which statistics are available.

Imports of transformers up to 1,500 kVA and 22 kV are restricted and it is presumed that the indigenous production is nearly sufficient to meet actual requirements in this range. There is, however, a considerable demand for the higher range as is indicated by the imports which have had an average value of about £1 million in the last three years. It has been estimated that the requirements of power and distribution transformers up to 33 kV would be 2·65 million kVA during the five-year period ending 1956 on the basis of complete utilization of power from the projects in hand. It is hardly likely that the industry will be able to reach this figure in the near future, for it is dependent to a considerable extent on imported raw materials which at the present time account for over half of the total.

Such items as electrical steel sheets and laminations, insulated copper wire and strip, electrolytic copper bars and wires, vulcanized fibre sheets and boards, and non-ferrous metals have to be imported from abroad. Steel tubes for transformers have also to come from abroad. The Planning Commission has recommended that " projects for producing the necessary raw materials be encouraged by the Government and that efforts be directed towards improving the quality of some of those which are now being manufactured here but are not up to standard."

Schemes are now under way for increasing the installed capacity from 370,000 kVA to 485,000 kVA per annum and the actual production to 450,000 kVA. The Kirloskar Electric Co. is in technical collaboration with the Brush Electrical Engineering Co., Ltd., of Loughborough, and has a scheme to increase the range to the 33 kV, 5,000 kVA level. The General Electric Co. of India is including transformers among the items manufactured in its factory and the initial rated capacity is expected to be about 15,000 kVA per annum. The Government plant at Bangalore will raise its production by an additional 30,000 kVA.

The motor manufacturing industry is in very much the

*Armature testing at the works of the Kirloskar Electric Co.*

same condition as the transformer industry. There are at present twelve factories with a total installed productive capacity of about 300,000 h.p. but the actual production has not yet exceeded 160,000 h.p. per annum. It is, however, steadily rising and has doubled since 1949 when production stood at 73,000 h.p. with a total value of about £350,000.†

The demand for motors from 1 to 50 h.p. was in the region of 200,000 h.p. per year and is expected to reach 320,000 h.p. by the end of 1956. To protect the home industry, restrictions have been imposed on the import of three-phase squirrel-cage and slip-ring motors up to 30 h.p. but all other types are allowed to be freely imported. The total value of imports has, however, steadily declined from £2·4 million in 1948 to £840,000 in 1951, and the Planning Commission has recommended that further protection be given to motors up to 75 h.p.

Raw materials are again the main difficulty; about £500,000 worth is being imported from abroad every year. Electrical steel sheet production is only about 5,000 tons per year while at least 2,000 tons is required for motors just to maintain the present level of production. Micanite, empire cloth and leatheroid are other items procured from abroad, but there is a possibility of meeting the ball bearings requirements from the expansion of the National Bearing Co., a new enterprise.

Among the factories with plans for expansion, the principal are Associated Electrical Industries, the General Electric Co., and the Kirloskar Electric Co. which are increasing their capacity and the range of their manufacture. The range is expected to reach the 100 h.p. level. There are also other firms engaged in specialist manufacture such as vertical-spindle motors and motors for textile machinery. The total capital programme is estimated at about £250,000 and is expected to meet most of the annual demand of 320,000 h.p. by 1956.

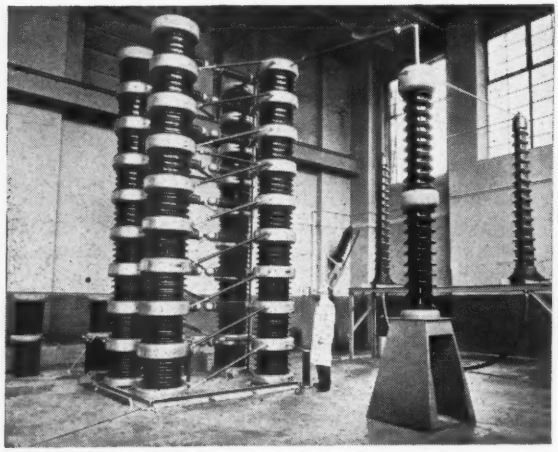
There is also another problem which the authorities seem reluctant to discuss and that is the quality of the product. The average Indian consumer still prefers foreign machinery, despite Government persuasion to the contrary, for somehow the home product is still far behind its foreign counterpart in performance, wear and tear and general quality. The complaint of shoddiness is in general evidence and the Five-year Plan makes a veiled reference to "the prejudice in the minds of consumers against indigenous machinery." Curiously enough, the only remedy it suggests is "restriction on imports . . . to enable the industry to withstand foreign competition." Perhaps the Tariff Commission, which is now looking into the matter, may come out with more direct and effective remedies such as quality control and a higher degree of commercial and technical integrity.

† Electric motors have maintained steady progress since the end of the war: 1946, 45,600; 1947, 38,400; 1948, 60,000; 1949, 73,000; 1950, 81,600; 1951, 141,600; 1952, 157,200; 1953, up to August, 115,900.

# Impulse Generator

A 1·5 million volt impulse generator has recently been installed in the North Woolwich high voltage laboratory of Standard Telephones and Cables, Ltd., to provide essential facilities for the development of power cables and associated accessories. The equipment facilitates investigation into impulse characteristics of all types of cables, high voltage capacitors, and their constituent dielectric materials under accurately simulated working conditions, thus enabling the materials to be used most effectively in the design of high voltage cables, accessories and capacitors. It has, therefore, an important bearing on the economic development of these products. The impulse strength of high voltage transmission systems is particularly significant, but a knowledge of the impulse strength of lower voltage systems is becoming increasingly important. The generator has a maximum crest voltage of 1,575 kV, and its energy output is 22 kW sec. It is arranged in nine individual stages, facilities being available for connecting in series or parallel to provide increased capacitance. The charging voltage is 175 kV at either polarity and is controlled by a moving coil regulator via metal rectifiers and step-up transformers. Surge voltage measurements are made with a capacity potential divider and are recorded visually and photographically with a sealed-off cathode ray oscillograph. In addition, one metre sphere gaps are available for use as a standard reference for voltage measurements.

*The Standard Telephones impulse generator facilitates investigation into the characteristics of cables, capacitors and dielectric materials*



## Broadcasting Aerials

In a paper presented before the Institution of Electrical Engineers' Radio Section on 1st December, Messrs. H. Page and G. D. Monteath gave the results of investigations into the vertical radiation patterns (v.r.p.) of medium-wave broadcasting aerials. Increasing wave-band congestion, they said, called for the achievement of the greatest coverage with each allocated wavelength. The potential service area might be limited either by interference, which could be overcome (where internationally permissible) by a sufficiently powerful transmitter, or by selective fading, which necessitated the reduction of radiation towards the ionosphere by controlling the pattern displaying radiated field strength as a function of the angle from the vertical. To lessen interference, the strength of waves reflected from the ionosphere was commonly reduced by the use of vertical aerials between 0·5 and 0·6 wavelength high. Four factors predominated: current distribution on the aerials; conductivity of the ground; flatness of its surface, which was more serious than was generally supposed; and diffuseness of ionospheric reflection, which had hitherto received too little attention. Experiments on models and on a mast radiator in service had resulted in semi-empirical solutions which were used in computing theoretical patterns that were in close agreement with the experimental conclusions.

# Heat Transfer and Thermodynamics

## Investigations at the Mechanical Engineering Research Laboratory

IN power generation heat transfer is of basic importance. All the energy which ultimately comes from a power station must have been transferred from the hot gases in the furnace to the water in the boilers. The heat exchange apparatus used in the steam cycle includes not only boilers, superheaters and condensers, but also much auxiliary plant such as evaporators, feed water heaters, oil fuel heaters, etc.

In almost all forms of internal combustion engine, including gas turbines, it is necessary to use radiators, coolers, exchangers, and other forms of heat transfer apparatus to achieve efficient performance or to keep working parts at suitable temperatures. The rating of an electrical machine depends primarily on heat transfer, since all the waste output must be taken away in the form of heat. Inadequate knowledge of heat transfer data may therefore result in unnecessary size and weight. In many process industries, in chemical engineering, and in industrial and domestic heating, more efficient heat transfer would lead to large savings in fuel.

Despite the importance of heat transfer, knowledge of its mechanics has lagged considerably behind that of most related subjects. For many years engineering undergraduates at British universities have been able to attend lectures and pass examinations in such subjects as strength of materials, theory of structures, and theory of machines. On the heat side there have been courses and examinations on applied thermodynamics, but, until recently, with only very limited reference to heat transfer.

Various stations of the Department of Scientific and Industrial Research have long been concerned with applied research in heat transfer within the limitations of their particular fields. Thus the Fuel Research Station studies the process of combustion and what happens to the heat produced, the work of the Food Investigation Organization involves the study of refrigeration, and the Building Research Station studies the heating of houses. By the end of the second world war, however, it had become evident that the amount of work in progress was small in relation to the great importance of heat transfer over a wide range of engineering practice. There was no organization which carried out fundamental research in the entire field of heat transfer, or applied research on heat transfer in relation to mechanical and electrical engineering.

### Work of the M.E.R.L.

Yet there were many matters on which information was urgently needed. The temperature range required to be considerably widened to cover present and future needs, while it was anticipated that recent developments in compressible flow of gases and transformation of energy would call for heat transfer under unprecedented conditions. The Guy Committee, set up in 1945 to report on the essential needs for research in mechanical engineering, concluded that there was a need for a new research organization of the D.S.I.R. to conduct basic and generic research, not carried out elsewhere, over the whole field of mechanical engineering. In accordance with its recommendations the Mechanical Engineering Research Laboratory (M.E.R.L.) was established in 1947. Its work is organized in seven main divisions, each responsible for research in a group of related subjects, one of which embraces heat transfer and thermodynamics.

M.E.R.L. is situated at East Kilbride, near Glasgow, where a large building programme is being undertaken on a site of about 70 acres. Building was started in October, 1949, but was considerably delayed by restrictions on Government expenditure introduced in 1951. In December last year, £6 million was granted to the D.S.I.R. for the erection of new buildings throughout the Department during the period 1954–59. This will enable much of the original building programme at East Kilbride to be completed by 1959. M.E.R.L. will then have a staff of between 600 and 700 and will be the second largest research station of the D.S.I.R. The buildings so far completed are the first stages of the properties of materials building, workshops, boiler-house, electrical substations, and staff restaurant. The hydraulic machinery laboratory is nearing completion.

### Proposed Specialist Laboratory

It had been hoped that construction of a specialist heat transfer laboratory would be started not later than 1951, but this project had to be deferred. It is now scheduled for commencement before the end of this year and should be available for occupation by the beginning of 1957. It will comprise physics-type laboratories for research on problems and physical properties not requiring large apparatus, together with two bays each 100ft long by 50ft wide.

The physics laboratories will contain facilities for the accurate measurement of temperature (and associated electrical measurements), and determination of thermal conductivity and other related properties, and will conduct small, carefully controlled experiments in heat transfer.

One of the large bays will provide facilities for research requiring larger apparatus and will be equipped with a medium-speed wind tunnel specially designed for heat transfer research. The other bay is for experimental work on a substantial scale on practical heat exchange problems. Industrialists having heat exchange plant which fails to do the work expected of it, or which gives performances exceeding expectations, may be able in appropriate cases to send it to M.E.R.L. for investigation. Its performance will be predicted theoretically in the light of data obtained in the physics laboratory and the apparatus will then be tried out in the heavy bay. Work of this nature requires substantial supplies of steam, electricity, etc., which will be provided on the following scale:—Steam at about 100 lb/sq in—8,000 lb/hr at any time, rising to 22,000 lb/hr when space heating load is off. Steam at 750 lb/sq in—3,000 lb/hr. Electricity—2,000 kVA. Cooling water—10 million B.Th.U./hr cooling tower. Refrigeration — 50 tons (i.e. about 600,000 B.Th.U./hr). Of the 2,000 kVA load, 1,000 kVA is available from five units each of 200 kVA capacity, which enable the output voltage to be varied from 0 to maximum and stabilized within $\pm\frac{1}{2}$ per cent. Two or more units can be paralleled for loads greater than 200 kVA. There is also 700 kVA of stabilized supplies for all medium and small power outlets, including a 125 kW stabilizer. The final 300 kVA is for pumps, lighting, etc.

The Heat Transfer and Thermodynamics Division consists at present of three sections under Mr. E. J. Le Fevre. One section is engaged in the collection and presentation of thermodynamic data for technically useful gases and gas mixtures. Another section deals with the more fundamental aspects of heat transfer, with special reference to such factors as convection under carefully controlled conditions. The third section is concerned with applied heat transfer, which embraces the testing of heat exchange plant. Experimental space has been made available to the Division in the properties of materials building, pending the completion of its own laboratory.

For some years the programme of work will be concerned with the correlation of existing data and its presentation in a form suitable for use in industry; measurement of physical properties such as conductivity and viscosity; convection inside pipes; heat transfer in the presence of condensation and ebullition; heat transfer in the unsteady state; and proof and semi-scale tests on heat exchange apparatus.

## Present Studies

Experiments already in progress include a study of the effects of an abrupt change of section, and of bends and elbows, on the heat transfer from a pipe to water flowing through it. Both abrupt divergence and abrupt convergence are being studied. Water flows from a constant head tank through an experimental pipe consisting of 9ft of 1in diameter and 18ft of 2in diameter pipe. Heat is generated in the pipe walls by the passage of a direct current along the pipe. The thickness of the pipe wall is so arranged that heat is generated at the same rate per unit length through the pipes, both before and after the change in section. Measurements are made of inlet and outlet water temperatures, water flow and heat input. Outside pipe-wall temperatures are measured at sufficient different positions to give a complete picture of distribution along the pipe. Inside wall temperatures and corresponding water temperatures are then calculated and the distribution of heat transfer coefficient along the pipe is deduced.

Plans have been made for a survey of heat transfer to liquid metals and apparatus has been installed for research on heat transfer to matrices and beds of broken solids.

It has been known for some time that in steam-condensing plants considerably higher rates of heat transfer can be obtained under dropwise conditions. If these conditions could be reliably maintained, a considerable saving in the capital cost of new plant should be possible, and the capacity of existing plant might be increased. An extra-departmental research was therefore sponsored at Queen Mary College, University of London, where a critical examination is being made of the mechanism of dropwise condensation, and the life of such surfaces. A fundamental investigation of the physico-chemical properties required of a surface promoting dropwise condensation has also been sponsored. The results of this work are likely to be of great value in power generation.

Sponsored research has been carried out at Cambridge on various aspects of the combustion process. This investigation has led to a general study of flames stabilized in a sudden enlargement of the duct through which the gases flow. It should contribute to the understanding of the stability and extinction of the flames of conventional gas turbines and ram jets, particularly at high altitudes. The aim of the work is to develop a method by which combustion equipment can be designed without the extensive experiments necessary at present.

The further development of steam boilers, turbines, refrigerators, internal combustion engines, and all types of heat engine is dependent on a knowledge of the fundamental thermodynamic properties of the working fluid over ranges of temperature and pressure far beyond those required by present-day practice. Outside the field of power generation there is an urgent need for thermodynamic data in the mechanical engineering and kindred industries. These needs are being met by the thermodynamics programme at East Kilbride, which falls into the following main divisions:—

(1) Preparation of tables of thermodynamic properties of technically useful substances.

(2) Obtaining thermodynamic data by arrangement with universities and other laboratories.

(3) Preparing tables of transport properties (viscosity and thermal conductivity) of various substances.

(4) Actual measurements of transport properties.

The important thermodynamic properties are enthalpy (total heat), entropy, specific and latent heats, free energy function, and P-V-T data. These properties are required for some 20 gases, so that the field to be covered is extremely wide. The huge task of determining them and presenting the results in a form suitable for industry is being carried out on a co-operative basis in Great Britain; as the scheme develops, it is proposed to extend it by collaboration with other countries.

The general procedure is to make critical draft surveys of existing data, from which master tables with skeleton versions and tolerances can be prepared. Working tables are then prepared for publication. The critical reviews also serve to show what further experimental work is required.

The advisory committee and various research workers in industry have collaborated in a number of surveys, which will shortly be published. The gases so far surveyed comprise air, acetylene, argon, ammonia, ethylene, propylene, carbon dioxide and propane.

The Division has also carried out some theoretical work on transport properties and measurements of conductivity are about to be started.

Within the Division an extensive bibliography of heat transfer literature and data is being assembled and indexed. A survey of part of the literature of heat transfer in the years 1948 to 1950 has been published. It covers conduction, forced convection excluding high-speed flow and compressibility effects, radiation, and heat exchangers. Further reviews dealing with particular aspects of the subject will be prepared. In view of the limited information available on heat transfer, the importance of this service to industry is very great.

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# "Unipede" Congress

THE tenth Congress of l'Union Internationale des Producteurs et Distributeurs d'Energie Electrique (International Union of Producers and Distributors of Electricity) commonly referred to as Unipede, is to be held in this country next year under the presidency of Lord Citrine, chairman of the British Electricity Authority. The working sessions of the Congress will last from 19th to 23rd September, and will be held at Church House, Westminster. It is expected that some 400 delegates will attend the Congress, in connection with which a number of study tours to various places in England, Wales and Scotland are being arranged.

Unipede, which has its permanent secretariat in Paris, was founded in 1925 and is an association of organizations which, in each country, primarily represent the interests in that country of producers and distributors of electricity. It is concerned with general economic and engineering problems of electricity supply and with international transfers of electricity and the compilation of international statistics.

# Brushless Variable-Speed Induction Motor

*Novel Principle Outlined in I.E.E. Paper*

RESEARCH initiated to discover the effect of constraining the movement of a conducting sheet threaded by a magnetic field moving in parallel with it formed the basis for the design of a variable-speed three-phase squirrel-cage motor without brushgear, which was described yesterday by Professor F. C. Williams and Mr. E. R. Laithwaite (Manchester University) to the Utilization Section of the Institution of Electrical Engineers.

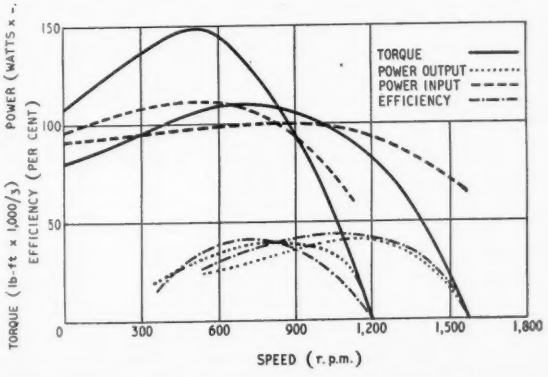
The underlying principle, that the sheet if free to move would assume a velocity equal to that of the field, was that of the normal squirrel-cage motor. In these experiments, however, the sheet was allowed to move only in its own plane and at an angle to the direction of motion of the field.

The origin of the proposal,the authors said, was the recent interest in linear three-phase motors as applied to the launching of aircraft and the pumping of liquid metals. These had a developed stator winding (i.e., opened out flat) and the magnetic field, which previously had angular velocity $\omega_s$, now had linear velocity $v_s = 2pf$ ft/sec, p being the pole pitch and f the frequency.

If an infinite (but weightless) conducting sheet were placed over the linear stator, eddy currents in the former would drive it when free to travel in the direction of the field motion. Resistance to motion would cause the sheet velocity, $v_c$, to fall below $v_s$ (causing slip) and draw power from the supply source. Conversely if the sheet were driven as an inductor generator at a velocity greater than $v_s$, power would be fed back to the supply.

If the sheet were made to move at an angle to the direction of the field, it would assume a speed, ideally, such that its component of motion along the direction of the motion of the field would be substantially equal to the field velocity.

Details were given of the experimental machines in which a copper disc rotated between a pair of " square "




linear stators wound to provide two pairs of poles along the length. Variations of speed with stator angle was about two to one when supplied at 150 c/s. The speed-torque curve shown in the accompanying diagram were taken at 600 c/s so as to give maximum power output. Full output efficiency was about 40 per cent. Input power per phase was 52·2 W at a mechanical output (including friction and windage) of 20·9 W. Of the balance of 31·3 W stator copper losses accounted for 21 W.

The paper was, the authors said, intended purely as an early statement of an observed effect that was believed to be novel and to possess at least qualitatively understood characteristics. Any possible practical applications must await further information about efficiency, construction costs and maximum speed range, concerning which investigations were proceeding. The tests indicated that all the properties of a normal squirrel-cage induction motor would presumably have their equivalent in the new machine. For example, given a start the machine would operate on single phase and still exhibit variable-speed properties.

Cylindrical barrels, as used with normal machines, would possess advantages over the discs used in the experimental machines, the main drawback of which was the change of surface speed with radius, which limited stator width, and hence pole pitch. With the cylindrical construction, however, the stator poles could not be rotated about the relevant axis without fouling the rotor. A spherical barrel would be free from this defect and was incorporated in a machine now being built which was expected to show much greater efficiency than the disc type.

## A.S.E.E. Diploma Scheme

IN continuing its policy of encouraging the education and training of technicians in the electrical industry, the Association of Supervising Electrical Engineers has now extended its diploma scheme to include the award of a Technician's Certificate in addition to the Swann Diploma.

The Swann Diploma examinations have now been extended to cover electrical manufacturing. These examinations comprise written papers of a standard equivalent to those of the Higher National Certificate, but are followed by oral examinations to ascertain the standard of early technical training and acquisition of adequate knowledge of the applications of electricity to industry and the economic problems associated with it. Emphasis is placed on knowledge gained by experience in installation, maintenance or manufacture of electrical plant and equipment, and upon the candidates' ability to pass on to others the correct methods of approach to the solution of practical problems and of putting solutions into practice. Credits are granted to show qualities of responsibility, and leadership, in addition to technical ability, administration and organization.

Examinations for the Technician's Certificate will be conducted on similar lines to those for the Swann Diploma. The syllabus includes written and oral examinations in basic principles and general applications, and has been carefully prepared to provide alternative specialized questions which can be selected by the applicant to suit his own particular sphere of experience. It is intended that the Technician's Certificate will provide a suitable stepping-stone for those who aspire to the higher qualification of the Swann Diploma and that both awards will encourage the endeavours of those who desire to advance in the industry, and will provide the employer with proof of the holder's technical and practical ability. Copies of a new brochure giving full details of the syllabus of the Swann Diploma and Technician's Certificate examinations can be obtained on application to the general secretary of the Association, 23, Bloomsbury Square, London, W.C.1.

# NEW ELECTRICAL EQUIPMENT

## Direct Switching Starter

A new direct switching starter of the air-break contactor type for textile machinery has been developed by ALLEN WEST & Co., LTD., of Brighton, in collaboration with the British Northrop Loom Co., Ltd., Blackburn. Designed for motors rated up to 7½ h.p. on single-, two- and three-phase a.c. supplies of up to 650 V, the starter, type "BNL," incorporates an easily removable "one piece" contactor unit so that, with interchangeable replacements, servicing is a simple matter.

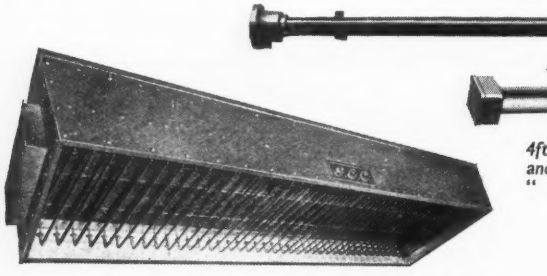
The totally enclosed contactor, which is operated by a three limb magnet, is of the triple-pole pattern with double break on each pole. The unit is assembled on two phenolic mouldings (a base and rocker) produced by Lorival Plastics. All contacts are faced with silver and electrical interlocks are provided for maintaining the operating coil circuit and for other purposes. Provision can be made where necessary for energizing the coil from a separate supply. The three magnetic overcurrent relays with adjustable oil dashpot time lags and a restrainer device are reset externally by a "stop/reset" push-button. Undervoltage release is inherent in the design of the contactor. Housed in a dustproof steel casing, the starter is fitted with a four-pole isolating switch interlocked electrically with the contactor and mechanically with the cover.

## Infra-Red Heating Panel

The increasing use of infra-red heating for the gelling of p.v.c. coated materials and for the setting of nylon fabrics has led to the introduction by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, of an infra-red panel designed to give uniform heating across the width of a material and so avoid discoloration through local overheating.

The panel measures 7ft long by 2ft wide and has 41 sheathed-wire elements arranged with their length at an angle to the direction in which material to be processed would flow. This arrangement gives freedom from streaking while the careful grading of the element ratings ensures uniformity of heating. An aluminium reflecting surface behind the elements directs the radiation and this is backed by glass fibre insulation to reduce convection losses. The elements near the panel ends are grouped in separately controlled sections so that the effective width can be varied to suit the processing of a range of material widths.

The panel has an angle iron framework and a sheet metal casing with a terminal box for mains connections at one end. The maximum rating is 20 kW.



*G.E.C. infra-red heating panel*

## Plating Control Indicator

The cross-pointer indicator made by MEASURING INSTRUMENTS (PULLIN), LTD., Eastern Works, Winchester Street, Acton, London, W.3, represents a new approach to control in the electro-plating industry.

*Pullin plating control indicator and (left) Allen West direct switching motor starter*

The plating vat ammeter and voltmeter are housed in one case, thus facilitating the taking of readings, while the point at which the pointers cross gives direct indication of vat loading and current density. Additional advantages are the lower cost and easier installation compared with the two separate meters normally used. Once the vat has been set up for the first batch by the foreman-plater it enables an unskilled operator to repeat the same conditions for all other batches on a production run.

## Flameproof and Horticultural Tubular Heaters

Two new additions to the range of Ekco "Thermotube" electric heaters announced by E. K. COLE, LTD., 5, Vigo Street, London, W.1, are a flameproof tubular heater and one suitable for horticultural purposes.

The type "FP" model is available in lengths of from 2 to 15ft and is suitable for use in places where Group II inflammable gases are present. It has been proved by the Ministry of Fuel's Buxton station and complies with B.S. 229. Construction is of heavy gauge steel tube and it has a special explosion-proof terminal chamber prepared for ¾in conduit entry. Loading per foot depends on the application and a range of 30 W to 60 W is available. Each heater is supplied with standard one-way wall fixing brackets and the finish is brown or grey heat-resisting paint. Voltages covered are 200/220 or 230/250 a.c. or d.c.; 100/120 V tubes can be supplied to order. The price is £4 plus 8s per ft length.



*4ft flameproof (above) and 2ft horticultural "Thermotube" heaters*

The horticultural pattern is both rust-proof and watertight and suitable for use in greenhouses, garden frames, etc., and also has many industrial uses. The tube itself is of aluminium and the terminal chamber of diecast construction. Lengths available are from 2 to 12ft. Wiring entry is prepared for ¾in conduit and the standard loading is 60 W per ft with voltage ranges as for the "FP" model. The price is 12s 6d plus 5s per ft length.

## Range of Alternators

Two types of British made alternators are offered by the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1. There is the conventional machine with separate exciter and automatic voltage regulator, and the more modern pattern without exciter or a.v.r. because it is self-exciting and self-regulating at all loads, and can readily be arranged for engine starting.

The standard machine, with salient poles, overhung exciter and a.v.r. is offered up to 85 kVA at 1,500 r.p.m. with revolving armature, or up to 125 kVA at 1,000 r.p.m. with revolving field. The a.v.r. holds the voltage steady within ± 1 per cent and the alternator design is such that harmonics and other circulating currents are the minimum. The waveform is approximately sinusoidal so this pattern is suitable for running in parallel with public supplies.

For independent and private supplies below 20 kVA the self-exciting and self-regulating alternator is perhaps more suitable since it is smaller, lighter, simpler and less expensive. On such unity power factor loads as lighting, cooking, heating, etc., the machines develop their maximum kW rating and automatically hold the voltage to within ± 2½ per cent. In ratings of 3 kVA and over they will also cope with a small amount of motor load provided the resultant power factor does not fall below 0·95. These alternators are also available for 0·8 p.f. loads. The outputs are then reduced and the voltage regulation drops back to the figure usual on public supplies (± 6 per cent).

## Diffuse Reflection Glass

It has long been realized that ordinary clear glass for instrument dial covers leaves a lot to be desired in service due to the incidence of reflection from the glass. After much experimenting, PILKINGTON BROTHERS, LTD., Sheet Works, St. Helens, Lancs., have produced a glass with both surfaces lightly obscured which successfully mitigates the nuisance of reflection without actually reducing the amount of light reflected. It is available in thicknesses of 2·6/3·2 mm and upwards, and at present in sizes up to 18in by 12in, and can be obtained toughened if required. Bent glass to approved curves is available as well as flat glass.

The glass is particularly suitable for meter and gauge glasses where the observer is some distance from the instrument panels and is unable to move to avoid reflections. The glass only functions satisfactorily, however, so long as the dial face of the instrument is reasonably close behind the glass.

## Improving Combustion Efficiency

A new boiler house instrument, known as the "Econometer," has just been brought out by KELVIN & HUGHES (INDUSTRIAL), LTD., 2, Caxton Street, London, S.W.1, in which means are provided for indicating whether the working flue gas heat loss is greater or less than a predetermined set figure by a varying band of colour. Independent illuminated scales show the temperature and $CO_2$ readings, and, when unburnt gases are present, a further light signal is given to warn the fireman to discount the significance of loss and $CO_2$ indications. Thus the instrument provides in a simple and readily understood form, the essential information necessary to enable the maximum fuel economy conditions to be maintained at all times.

## Wool Carding Control

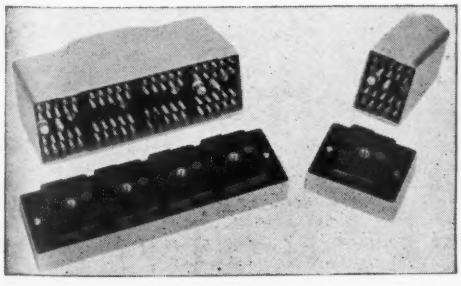
Equipment for measuring the density of the wool web on a carding machine and controlling the machine to provide uniform slubbings has been developed by Lancashire Dynamo Electronic Products, Ltd., in association with Mr. C. Liversidge, of James Watkinson & Sons, Ltd., and the Wool Industries Research Association. The complete control equipment is now being produced by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs, under licence from the Wool Industries Research Association.

In the equipment a photo-electric cell is used to measure the degree of attenuation of a beam of light passing through the web, the output of the cell being amplified and ultimately used to control an electric servo motor which varies the ratio of an adjustable ratio transmission unit inserted in the drive between the swift and the doffer and condenser. The speed of the latter section of the machine is thus varied with respect to the speed of the swift in order to provide a product of approximately constant weight at all times.

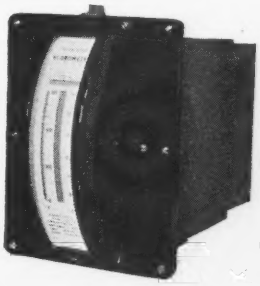
## Multi-Way Connectors

Growing interest in unit construction in the electronic and light engineering fields has led the PLESSEY CO., LTD., Ilford, Essex, to make a new range of multi-way connectors giving 20-way, 30-way, 40-way, 60-way and 80-way linkages. The plugs and sockets of these connectors are compact, and each is contained within a rectangular aluminium case. Units may be packed closely together on a chassis or panel to suit almost any requirements. The plug and socket contacts are silver plated and so made as to provide positive connection when fully engaged, but giving a self-ejecting action when being disconnected. This ensures the lowest possible contact resistance.

*Below : Plessey multi-way connectors*

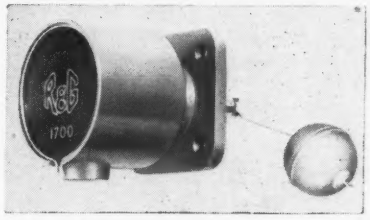


*Kelvin & Hughes "Econometer"*



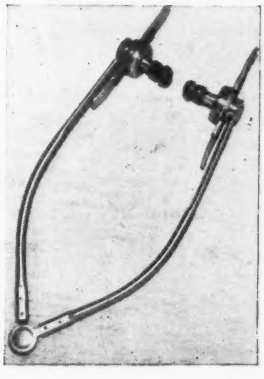
## Liquid Level Switch

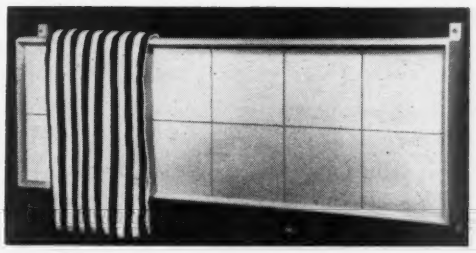
The latest type of flange mounted liquid level switch to be made by BAYHAM, LTD., 12, Lower Grosvenor Place, London, S.W.1, is known as the type 1700 and is designed for mounting on the side of tanks for the purpose of operating electric warning signals when the liquid either rises or falls to predetermined levels. The 250 V 6 A mercury switch mechanism is operated by the rotation of a short float arm, the coupling between switch and float arm being made magnetically through the body of the instrument, thereby ensuring complete absence of leakage under pressure or vacuum conditions. The instrument is pressure tested to 80 lb/sq in and the casing is weatherproof.




*Bayham liquid level switch*

The instrument may be supplied with the switch set either to make or break contact on changing levels, and the switching differential is 1¼in equally spaced about the centre line. For traction and marine use a modified switch mechanism is employed which permits a special type of mercury switch to be tripped through 90 deg, thereby ensuring that the mercury will not leave the contacts under normal operating conditions. This model is usually supplied with a longer float arm and larger differential to prevent "hunting" of the mechanism under conditions of liquid swirl. Other models are available for use in high pressure tanks, and modification can be made to suit corrosive conditions.





*"Panelair" non-metallic towel and clothes airer*

## Towel Airer

A towel and clothes airer now being marketed under the trade name "Panelair" by PANEL HEATERS, 77, Dean Street, London, W.1, embodies a non-metallic element which is completely shrouded in an insulated envelope before assembly. Being bonded into the panel itself, it is claimed to have a high safety factor and no earthing is required. Loading of the "Panelair" is 200 W at voltages between 200 and 250 V, a.c. or d.c., and the temperature is in the region of 135 deg F. The panel measures 3ft by 1ft and the total weight is 5½ lb, the retail price being £5 10s plus £2 0s 3d purchase tax in the United Kingdom.

## High-Speed Counter Tube

The new high-speed decade counter tube, type E1T, which is offered by MULLARD, LTD., Century House, Shaftesbury Avenue, London, W.C.2, is of the hard-vacuum type and is therefore capable of much higher counting speeds than cold-cathode gas-filled decade counters. The counting rate is limited only by the associated circuitry, and counts of 30,000/sec are readily attainable.

The basis of the tube is a ribbon-shaped electron beam which can be deflected into ten well defined positions by the input signals. In any of these positions the beam passes through one of ten apertures in a cylindrical anode and impinges on a fluorescent screen, causing a spot of light to appear opposite the appropriate figure marked on the tube envelope. As the last position is passed by the beam a signal can be generated to re-set the tube to zero and simultaneously apply a counting pulse to the next tube in the chain.

## Induction Earphones

Radio earphones which have no trailing wires and thus give the wearer complete freedom of movement are being made by the MAGNETIC BROADCASTING CO., LTD., Suffolk Hall, 1, Upper Richmond Road, London, S.W.15, under the trade name "Stethophones." They derive their input by induction pick-up from a wire loop, encircling the room or building in which they are used, which is connected to the output transformer of the amplifier or radio receiver providing the speech or music. Any number of earphones can be used on one such circuit without consuming extra power. No valves, batteries, wire or cords are required and there is a volume control at each earpiece. Each pair weighs less than 2 oz.

*Left : Magnetic Broadcasting Co.'s "Stethophones"*

# LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

## Storage Space Heating

IT is gratifying to notice the interest which is now being taken in thermal storage space heating devices. In 1930 and earlier we were advocating that these devices (which had been developed in Switzerland following the first World War and the coal shortages it produced in that country) should be adopted in Great Britain. Several articles to that end were published and in particular we published jointly in 1931 a description of an improved thermal storage heater which we had developed in conjunction with one of the Swiss manufacturers. The improvements were covered by a provisional patent. No British manufacturer made heaters of the solid core thermal storage type at that time and supply authorities here appeared not to be interested in them.

An experiment was made later by us on a type of storage heater working at constant temperature (thus avoiding one of the disadvantages of the solid core type of heater) and a description of that experiment was also published.

It is appreciated that conditions in this country at the present time may be particularly favourable to the adoption of thermal storage heating despite higher coal costs, provided that attractive off-peak tariffs are available to the consumer. We wish therefore to draw attention to these earlier articles as they add further point to the arguments and examples now appearing in the Press. Typical references are:—

"The Off-peak Heating Load." Sims. *Electrical Review*, 1st and 8th March, 1929.

"Solid-core Thermal-Storage Heating Units." Sims and Sturley. *Engineering*, 1st and 22nd May, 1931.

"An Experiment on Electro-Thermal Storage at Constant Temperature." Sims and Sturley. *Engineering*, 22nd January, 1932.

*Southampton.* L. G. A. SIMS,
K. R. STURLEY.

## Standard Frequency Transmissions

WITH reference to the report in your issue of 19th November of the I.E.E. meeting on MSF standard frequency transmissions, the remarks of one or two speakers in the discussion may, as reported, be somewhat misleading. May I therefore make it clear, as I hoped I had done in the discussion, that the responsibility for monitoring and, if necessary, adjusting the frequency of these transmissions and their modulation rests entirely with the National Physical Laboratory?

*Teddington.* R. S. J. SPILSBURY,
*Superintendent*, Electricity Division,
National Physical Laboratory.

## Oil-Filled Cable Leakages

ANSWERING Mr. J. H. Morgan's letter on page 800 of your issue of 19th November, the leakages referred to in my article have not normally been caused by corrosion, but have in most cases been due to accidental damage or other purely mechanical causes. As no doubt Mr. Morgan is aware, modern high voltage cables are protected by means of a very efficient anti-corrosion serving, which may comprise rubber or p.v.c. protection, and it appears that under all known conditions this protection is adequate.

The application of cathodic protection may be found of value in cases where older cable systems not having highly efficient anti-corrosion servings become exposed to new corrosion risks arising from later industrial or transport developments, or from subsequent introduction of buried metal structures or mains to which the cable may become anodic.

Even when the desirability of the method has been established, however, individual action by the authority concerned only with the preservation of the cable might be ruled out on account of the danger to adjacent buried metal plant or structures which this might involve, and it would be essential to obtain the consent and co-operation of those responsible for such plant and to formulate a scheme which would be acceptable to all.

*Southampton.* A. L. ASHTON.

## Submarine Cables

IN your issue of 5th November there is a paragraph on page 749 in which it is stated that the thirty-five mile long cable linking the Manicouagan and the Gaspe Peninsulas in the Province of Quebec is believed to be the longest under-water power transmission cable in the world. I would, however, like to draw the attention of your readers to the fact that such a belief is incorrect and that there is already in service in the Baltic a power transmission cable of a length of just over sixty miles between the mainland of Sweden and the island of Gotland. The capacity of this cable is 20 MW at 100 kV and it forms the conducting channel for the first major high voltage d.c. project in existence. This scheme was inaugurated in March last.

*London, E.17.* D. S. YOUNG,
*Sales Director*,
Asea Electric, Ltd.

[The Manicouagan–Gaspe cable is an a.c. installation. — Editors, *Electrical Review*.]

## The Late Mr. H. Nimmo

IT was with great regret that the members of the Electricity Supply Board and other electrical organizations in Burma heard of the death of Henry Nimmo.

Mr. Nimmo was well remembered as Government Electrical Engineer from 1909 to 1923 and he trained several people who are engineers in Burma to-day. A few months ago he accompanied the Mission headed by Lord Burghley and he showed then his great interest in the industrial development of Burma and he also met many of his old friends.

All of us in Burma respected him and express our great regret at his death.

*Rangoon, Burma.* J. A. HILL,
Government Senior Electrical Inspector.

## A.S.E.E. Social Events

The ladies' night (dinner-dance and cabaret) of the Association of Supervising Electrical Engineers will be held on 25th February next at the Trocadero Restaurant, London, W.1, and the annual dinner of the Association will take place on 1st April at the Connaught Rooms, W.C.2.

# Electricity Supply Inquiry

SIMPLER tariffs common to all areas are advocated by the Association of British Chambers of Commerce in written evidence submitted to the Herbert Committee of inquiry into the electricity supply industry. The Association suggests that industrial and commercial users of electricity are being charged at too-high rates. Special off-peak tariffs are considered to be necessary as a means of levelling the load.

Other proposals made are that the consultative councils should be reorganized to give better representation to various classes of consumers according to their consumption and that there should be a central consultative council empowered to consider matters relating to the generation of electricity, including its cost.

The National Council of Social Service is concerned about the effects of the new standard tariffs on the cost of maintaining the buildings owned and rented by its member organizations (village halls, residential homes for children and old people, hostels for workers, etc.). The Council feels that the classification of such non-commercial and non-domestic groups of consumers leads in many instances to an excessive increase in electricity charges and reveals anomalies in the tariff structure. For example, the calculation, under commercial tariffs, of the primary kWh on the total loading of all electrical equipment is considered unjustified when applied to non-commercial undertakings.

It is also contended that there is a wider disparity between the tariffs in different areas than is warranted by the conditions. In some areas modifications have been introduced which have helped to correct anomalies and the experience in these cases should be made available to other Boards.

The National Association of Parish Councils, representing 5,400 of the 7,400 Parish Councils in the country, is critical of Consultative Councils, saying that their reputation in rural areas is low. Two reasons given are first, that it is considered a waste of time to complain to a body which cannot redress the complaint when an equally accessible body is available which can; and secondly, that there is a deep-rooted public dislike of bodies nominated from above rather than appointed from below.

The memorandum goes on to say that the electricity supply industry is in the strongest possible bargaining position against the individual consumer and some Electricity Boards appear to be using their ability to "turn out the light" to force upon customers policies not always convenient or strictly in the public interest. It is suggested either that Consultative Councils should be abolished and that the Boards should be enlarged to include representatives of all classes of local authorities, or that there should be substituted for the Councils supervisory committees appointed directly by local authorities and associations of local authorities.

Legislation should be introduced imposing on Boards the legal obligation to supply energy where reasonably possible to any consumer who requires it and who is prepared to pay a reasonable price. This should be enforceable in the first instance by action in the County Court and the judge, sitting with a specialist assessor, should have power not only to decide whether the Board's obligations can reasonably be enforced, but to fix the terms of the contract as well.

Dealing with service, the memorandum declares that meters should be situated outside the "front door" in a locked box to which the householder and meter reader should have access.

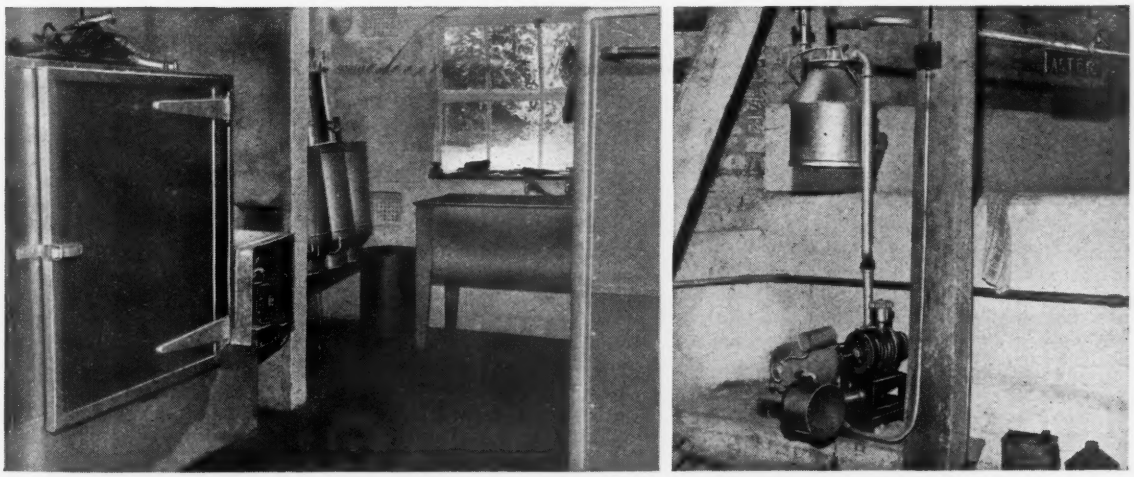
Finally, it is said that the Association "would welcome a public statement on the priorities at present being accorded to the development and mass production of heat storage apparatus and to experimental work on the storage of electrical energy in other ways."

# Dairy Farm Installation

AMONG the many farming installations carried out recently by the South Eastern Electricity Board, East Sussex & South West Kent Sub-Area, is one at Sussex House Farm, Cowden, belonging to Mr. John Mills, the actor. Previously there was a private generating plant comprising a Petter diesel engine driving an E.C.C. 110–140 V 31 A d.c. generator.

The premises have now been completely rewired by the Board in p.v.c. covered cable and the most up-to-date electrical dairy facilities have been provided for dealing with the herd of Guernsey cows. Milking is carried out by means of two Gascoigne "Mobilette" two-churn mobile recorders, the milk being cooled by a "Rotorfreeze" in-churn cooler with enclosed churn cabinet. Hot water for washing purposes and steam for the Woolley 27 cu ft sterilizing chest, churn stool and clusters are supplied by an Electrobloc "2B" unit. Grinding of grain is undertaken by means of one of the new Bentall "Wizard" hammer mills.

A G.E.C. charger keeps the tractor, etc., batteries in good condition. Lighting throughout the cowhouse and dairy has been carried out by means of Crompton Parkinson vapourproof fluorescent fittings.



*The dairy at Sussex House Farm, Cowden, showing the "Rotorfreeze" in-churn cooler and a corner of the "Electrobloc" unit. Right: The milking machine*

# PERSONAL AND SOCIAL

## *News of Men and Women of the Industry*

**Sir John Black** has joined the board of Enfield Cables, Ltd., and has been appointed deputy chairman, in which capacity he will assume responsibility to the board for the executive control of the business. The appointment is not whole time but Sir John has agreed to devote to these duties whatever time is necessary for their effective discharge. Sir John joined the Standard Motor Co., Ltd., in 1929 and became managing director in 1934. About a year ago he received injuries in a car accident, and although he became chairman in the following month, three weeks later, on medical advice, he resigned all his offices with the company. **Lord Verulam** has ceased to be a director of Enfield Cables, Ltd.

**Mr. G. G. Roberts,** M.Sc., has joined Smiths Aircraft Instruments, Ltd., as technical executive in charge of the company's guided weapon activities, and has taken up his duties at Cheltenham. After a period of lecturing in London, Mr. Roberts joined the Ministry of Aircraft Production and was engaged on radar research and development. In 1947 he joined the staff of the Royal Aircraft Establishment at Farnborough, and worked in the newly-formed Guided Weapon Department.

**Mr. H. D. McGough,** who has been elected for the third year in succession as president of the Society of Irish Electrical Traders, is well known in the electrical trade as manager for the General Electric Co., Ltd., in the Republic McGough is also of Ireland. Mr. chairman of the Executive Council of the S.I.E.T. as well as chairman of the Manufacturers' Section of the Society. He is a member of a number of trade organizations and has been hon. secretary and organizer of the Electrical Industries Benevolent Association, Dublin (1938 to 1951), and chairman (1952 to 1953).

*Mr. H. D. McGough*

Two new appointments are announced by E. K. Cole, Ltd., as a result of the increasing scope of the company's activities and widening technical fields in which it is engaging.

**Mr. A. J. Brunker,** B.Sc.(Eng.), A.C.G.I., D.I.C., A.M.I.E.E., relinquishes his position as general export manager of E. K. Cole, Ltd., to become chief engineer of the company; **Mr. W. M. York,** who as an executive director already controls Ekco publicity and the heating division of the company, will, in addition, now direct the company's export activities covering radio, television, plastics and ciné

*Mr. A. J. Brunker*

*Mr. W. M. York*

equipment. Mr. Brunker will be responsible to Mr. A. W. Martin, M.B.E., technical director, and will assist him in the general administration of the Development and Engineering Department. Mr. Brunker retains his directorship in Ekco Electronics, Ltd., the wholly-owned subsidiary. Before joining E. K. Cole in 1947, Mr. Brunker was with the Ministry of Supply where, for several years, he held the position of Deputy Director, Radio Production.

The Ministry of Supply announces that **Dr. A. G. Touch** has been appointed Director of Electronics Research and Development in succession to **Air Commodore W. G. Pretty.** Dr. Touch, who is forty-three years of age, has been Deputy Director, Electronics Research and Development (Air), since 1952. **Air Commodore C. A. Bell** will succeed Dr. Touch as Deputy Director, Electronics Research and Development (Air). He was Deputy Director, Communication Development (now D.L.R.D.), from 1946 to 1948, and is at present S.A.S.O., No. 90 Group, Air Ministry.

**Mr. H. F. Spencer** has been appointed chairman of the British Institute of Management in succession to **Sir Hugh Beaver.** Mr. Spencer is managing director of Richard Thomas & Baldwins, Ltd., and a director of the Steel Co. of Wales, Ltd.

Lt.-Gen. Sir Otto Lund, Commissioner-in-Chief of the St. John Ambulance Brigade, was guest of honour at the B.T.H. Willesden Works on 26th November when members of the **138 B.T.H. (Willesden) Division** held their annual dinner. Mr. H. E. Cox, manager of the works and president of the Division, was in the chair and presented divisional awards.

**Mr. W. A. Turner** has resigned his post as head of the Electrical Engineering Department of the Brighton Technical College and will be succeeded by **Mr. S. W. B. Leathlean,** M.Sc.(Eng.), A.M.I.E.E., lecturer in electrical engineering at the Monmouthshire Technical College, as from 1st January next. **Mr. P. Godfrey** has resigned his position as lecturer in electrical engineering at Brighton and is being succeeded by **Mr. N. L. White,** B.Sc.(Eng.).

**Mr. T. H. Bertram,** chief electrical engineer for No. 3 Area of the Northern Coal Board, has been transferred in a similar capacity to No. 1 Area.

**Mr. H. R. Mallett** has recently retired from the service of Siemens Electric Lamps & Supplies, Ltd. He joined Siemens Brothers Dynamo Works, Ltd., in 1907, serving with them until 1914, when he joined the 8th London (T.A.) Howitzer Brigade, R.F.A. In 1915 he was gazetted to the Middlesex Regiment. He was wounded three times and was awarded the M.C. and Bar. Returning to Siemens in 1920 he stayed with them until 1923 when for a time he left the company, rejoining in 1931, this time with Siemens Electric Lamps & Supplies, Ltd., becoming that company's representative for domestic appliances. In 1940 he returned to the office staff, taking charge first of the lamp office and subsequently of the Heating Department. In 1948 Mr. Mallett was appointed publicity manager for Siemens Brothers and Siemens Electric Lamps & Supplies, Ltd., later becoming manager of the Lamp Co.'s Accessories and Heating Department.

*Mr. H. R. Mallett*

Siemens Electric Lamps & Supplies, Ltd., have appointed **Mr. J. Hamilton** as joint manager for Scotland in conjunction with Mr. T. D. Childs. Since leaving the Royal Air Force in 1945 Mr. Hamilton has been manager of the sales department of Walker, Sons & Co., Ltd., Colombo, agents in Ceylon for Siemens Bros. & Co., Ltd.

**Mr. A. E. Camp,** principal assistant in the Purchasing Department at the head office of the South Wales Electricity Board, is shortly to retire after serving for forty-six years with the Board and its predecessors. **Mr. C. J. Plaisted,** formerly a senior assistant in the Purchasing Department, has been appointed to succeed Mr. Camp.

**Mr. H. Tomlin,** Graduate I.E.E. (an assistant engineer with the Yorkshire Electricity Board) has been appointed first assistant district engineer, District 101/102 (Haverfordwest, Narberth, Milford Haven) of the South Wales Electricity Board, in succession to **Mr. G. V. Vaughan,** Associate I.E.E., who was recently appointed district engineer, District 101/102.

**Mr. J. A. Reid** has joined Mersey Cable Works, Ltd., as sales engineer for the North-East Coast and **Mr. D. H. Wingrove,** who has been sales engineer for Yorkshire and the North-East Coast, will in future be responsible for Yorkshire only.

**Mr. L. Satchwell,** whose resignation from the board of directors of the Rheostatic Co. Ltd., was reported last week, founded the business in 1921 and his efforts were responsible for its growth and expansion until his retirement from executive management in 1947. Since that date he has continued to serve on the board but now resigns his directorship for health reasons.

**Mr. P. J. Browning,** formerly with S. Smith & Sons (Radiomobile), Ltd., has joined Pye Telecommunications, Ltd., as sales manager, Car Radio Division.

**Mr. A. G. R. Bell,** A.M.I.E.E., A.M.I.Mech.E., superintendent of Bromborough power station in the North West, Merseyside and North Wales Division of the British Electricity Authority, has been appointed generation engineer (operation), Southern Group, South Western Division, in succession to **Mr. P. L. Lutte,** who has transferred to the Northern Group. After serving an apprenticeship in the Sheerness and District Electricity Co.'s power station, Mr. Bell joined the Burnley Corporation in 1930 as junior assistant engineer. He subsequently served in a number of electrical engineering capacities with the North Eastern Supply Co., the L.N.E. Railway, the South Lancashire Transport & Power Co., the Lancashire Electric Power Co. and the Coventry Corporation. On the establishment of the B.E.A. in 1948, Mr. Bell was superintendent of Wallasey power station and he continued this work until June, 1950, when he took up his present duties.

*Mr, J. H. Barham*

*Mr. J. L. Woollett*

*Mr. J. B. Livesey*

**Mr. F. W. Dale,** B.Sc., A.R.I.C., A.M.C.T., M.Inst.F., has been appointed divisional chemist to the British Electricity Authority, North West, Merseyside and North Wales Division. He succeeds Mr. A. B. Owles, who recently retired. Mr. Dale was divisional chemist in the former Merseyside Division, a position he had held since August, 1948. Previously he served with the Eastern Division as chemist and efficiency engineer at Norwich generating station.

*Mr. F. W. Dale*

**Mr. P. A. T. Bevan,** B.Sc., of the Engineering Division of the B.B.C., has been appointed chief engineer by the Independent Television Authority. Mr. Bevan is a member of the I.E.E. and has received the Duddell and Radio Premiums of the Institution.

The Tunbridge Wells Branch of the **Electrical Contractors' Association** held its annual dinner-dance at the Spa Hotel, Tunbridge Wells, on 2nd December, approximately 160 members and guests attending. Mr. B. N. Poile proposed the toast of the "Civic Authorities of West Kent and East Sussex" and the Mayor of Tunbridge Wells responded. The toast of the Association was proposed by Mrs. E. Viner, J.P., chairman of the Sevenoaks Urban District Council, and Mr. R. A. Marryat (vice-president of the E.C.A.), in reply, said that an inadequate installation could not be a good or a particularly safe one. The toast of the ladies and guests was proposed by Mr. H. Featherstone and Mr. R. Graham Weekes replied.

The Telegraph Construction & Maintenance Co., Ltd., announces the appointment of branch managers of three new branches which have been opened in Birmingham, Nottingham and Cardiff. **Mr. J. H. Barham,** Associate I.E.E., is in charge of the new branch at Gloucester House, 270, Corporation Street, Birmingham (telephone: Birmingham, Central 6191); **Mr. J. L. Woollett,** A.M.I.E.E., becomes manager of the branch at Potters Buildings, Warser Gate, Nottingham (telephone: Nottingham 44559); and **Mr. J. B. Livesey,** A.M.I.E.E., takes over the responsibilities of the branch at 16-17, Hills Terrace, Cardiff (telephone: Cardiff 27467).

During a recent ceremony, Mr. E. Robertson, manager, London and South East Area of the English Electric Co., Ltd., presented **Mr. A. S. Gibson** (who retired from the company last June) with gifts from his colleagues at Queen's House, Kingsway, London. These included a refrigerator, a radio set and a cheque. Mr. Gibson, who was educated at the Royal Technical College, Glasgow, and Glasgow University where, in 1910, he obtained his B.Sc.(Eng.), joined Siemens Brothers Dynamo Works, Ltd., at Caxton House, Westminster, in 1913. When this company became part of the English Electric group he stayed on and, except for service in the 1914-18 war, he has a record of unbroken service covering over forty-one years. Mr. Gibson was wounded during the Battle of the Somme in 1916 and was mentioned in despatches during the March retreat of 1918. During the last war he worked on Government and Services liaison, being closely connected with work on factory extensions for armament production, including aircraft, naval ordnance work, marine propulsion and general Service requirements.

*Mr. A. S. Gibson (left), who recently retired from the English Electric Co., Ltd., receiving presentations from Mr. E. Robertson, manager for London and the South East Area*

The London Electricity Board has appointed **Mr. S. Morton Gore,** LL.B., D.P.A., of Wolverhampton, to the position of secretary of the Board upon the retirement of Mr. W. H. Warhurst. He will be taking up his duties on 1st March.

**Mr. G. C. W. Com'ey,** at present station chemist at Earley power station, near Reading, has been appointed chief chemist at the new power station at Stella North, near Newcastle-on-Tyne.

The annual dinner of the North East London Branch of the **Association of Supervising Electrical Engineers** was held at the Angel Hotel, Ilford, on 27th November and was attended

by ninety-three members and guests. Mr. E. A. Bromfield, the Association's general secretary, and Mrs. Bromfield were the guests of honour. A past chairman's certificate was presented to Mr. D. H. Taylor and inscribed compacts to the ladies of the five former chairmen. Mr. G. E. Hutchinson, this year's branch chairman, presided.

**Mr. T. O. Freeth,** of the E.L.M.A. Lighting Service Bureau, London, recently completed a series of lectures on lighting in Pontypool, Bridgend, Aberdare and Llanelly at the invitation

*Left: Mr. N. B. W. Castleton (Cryselco, Ltd.) with Mr. T. O. Freeth (Lighting Service Bureau) after a tour of Nantgarw Colliery*

of the Bureau's South Wales Advisory Committee. During his visit to South Wales Mr. Freeth, with **Mr. N. B. W. Castleton,** Cardiff branch manager of Cryselco, Ltd., made a three-mile tour underground to see the lighting at Nantgarw Colliery. The accompanying picture was taken after the tour.

## OBITUARY

**Mr. Harold Barker,** M.Inst.F., manager of the Newcastle office of Babcock & Wilcox, Ltd., has died at the age of forty-nine. Mr. Barker had been with Babcock & Wilcox since 1921, except for a short period in 1927 and 1928, which he spent in the merchant service, on the engineering staff of the "Berengaria." He had had extensive sales experience in Leeds and London and was appointed manager of the Newcastle Office in 1950.

**Mr. W. M. Horsfall.**—The death occurred on 1st December of Mr. William Miles Horsfall, M.I.E.E., who for nineteen years, until his retirement in 1935, was associated with the Edison Swan Electric Co., Ltd., at its Liverpool branch. He joined the branch as chief outside representative. Mr. Horsfall was previously with the Liverpool Electric Supply Co., Ltd. (1894 to 1910), and for six years carried out consulting work.

**Mr. G. S. Ramage,** secretary and financial director of the Harland Engineering Co., Ltd., died at his home in Alloa on 19th November. Mr. Ramage had been secretary of the company since 1923 and financial director since 1953.

**Mr. H. A. White,** chief draughtsman in the Stoke-on-Trent Electricity Department from 1927 to 1944, died on 22nd November, aged seventy-nine. Mr. White previously held similar appointments with Worcester Corporation and John Spencer, Ltd., Wednesbury.

## WILLS

**Mr. W. L. Barber,** founder and chairman of the Midland Electric Manufacturing Co., Ltd., who died on 9th August last, left £59,030 gross (£58,309 net).

**Mr. A. J. Cridge,** late secretary of the transformer, industrial capacitor and converting plant sections of the British Electrical and Allied Manufacturers' Association, who died on 21st August, left £1,506 gross (£1,439 net).

**Mr. R. J. Bullivant,** electrical contractor, former chairman of the Southern Sectional Board of the E.C.A., who died on 20th April, left £3,945.

**Mr. W. H. Fellingham,** founder of W. H. Fellingham & Sons, Ltd., who died on 26th June, left £9,395 gross (£9,237 net).

**Mr. W. A. R. Manning,** a director of the Ever Ready Co. (Great Britain), Ltd., who died on 26th September, left £17,189 gross (£5,955 net).

**Mr. T. F. Lister,** chairman of Hackbridge & Hewittic Electric Co., Ltd., who died on 13th July last, left £44,454 gross (£43,228 net).

**Mr. W. H. Goodman,** chairman of the Dubilier Condenser Co. (1925), Ltd., who died on 15th September, left £23,026 gross (£22,236 net).

**Lt. Col. Sir John Dawson Laurie,** late director of Charing Cross Electricity Supply Co., Ltd., who died on 20th July, left £215,875 gross (£215,473 net).

**Mr. C. S. Kent,** a director of Gresham Transformers, Ltd., who died on 30th July, left £25,993 gross (£25,901 net).

**Mr. C. B. Collins,** executive director of the British Vacuum Cleaner & Engineering Co., Ltd., who died on 15th July, left £27,338 gross (£27,279 net).

**Mr. W. Allcock,** chief engineer of Erskine, Heap & Co., Ltd., who died on 20th August, left £4,452 gross (£4,344 net).

**Mr. L. R. Nixon,** chief of research and development, J. Stone & Co. (Deptford), Ltd., who died on 19th June, left £8,245 gross (£7,196 net).

# MALAYA'S ELECTRICAL IMPORTS

IMPORTS of electrical machinery, goods and apparatus into Malaya last year fell by about 25 per cent in value compared with 1952. The total was 65 million Malayan dollars, of which the United Kingdom accounted for 52 million. Other supplying countries, in a small way, were the Netherlands ($4,251,000), United States ($2,515,000), Germany ($2,031,000), and Australia ($1,266,000). All these countries shared in the decline, and Japan lost ground. The following table shows the values of the principal groups in 1953 with notes of increases or decreases compared with 1952 (Malayan dollar = 2s 4d).

| Class of Equipment | 1953 Malayan $ (000) | Inc. or dec. on 1952 Malayan $ (000) |
|---|---|---|
| Convertors and transformers | 2,121 | − 135 |
| *From U.K.* | 1,742 | − 576 |
| *,, Australia* | 230 | + 230 |
| Generators | 5,564 | − 412 |
| *From U.K.* | 5,187 | + 601 |
| *,, U.S.A.* | 117 | − 384 |
| *,, Germany* | 230 | − 46 |
| Motors 25 h.p. and under | 929 | − 156 |
| *From U.K.* | 841 | − 70 |
| *,, U.S.A.* | 22 | − 49 |
| Motors 25 h.p. to 100 h.p. | 701 | + 266 |
| *From U.K.* | 571 | + 223 |
| *,, U.S.A.* | 50 | + 20 |
| *,, Switzerland* | 69 | + 69 |
| Motors over 100 h.p. | 328 | − 98 |
| *From U.K.* | 273 | − 105 |
| *,, Italy* | 53 | + 21 |
| Switchgear | 1,730 | − 945 |
| *From U.K.* | 1,721 | − 836 |
| Automobile lamp bulbs, etc. | 87 | − 101 |
| *From U.K.* | 67 | − 26 |
| *,, Netherlands* | 3 | − 16 |
| *,, Hungary* | 14 | − 39 |
| Flash, radio panel and cycle dynamo bulbs | 236 | − 337 |
| *From Netherlands* | 123 | + 65 |
| *,, U.S.A.* | 25 | − 371 |
| *,, Hongkong* | 75 | + 29 |
| *,, U.K.* | 11 | − 55 |
| Fluorescent lamps (not h.v.) | 241 | † |
| *From U.K.* | 123 | † |
| *,, U.S.A.* | 90 | † |
| *,, Netherlands* | 25 | † |
| Wires and cables, not telegraph or telephone, rubber insulated | 5,587* | + 410 |
| Ditto, insulation other than rubber | 5,856* | + 329 |
| Ditto, telegraph and telephone (submarine) | 424 | + 133 |
| *From U.K.* | 424 | + 334 |
| Ditto, other | 1,966* | + 1,389 |
| Electro-medical apparatus, X-ray and vacuum tubes | 437 | + 199 |
| *From U.K.* | 191 | + 108 |
| *,, U.S.A.* | 80 | + 34 |
| *,, Netherlands* | 112 | + 4 |
| Electric supply meters | 538* | + 122 |
| Electric meters, except supply | 329 | + 80 |
| *From U.K.* | 321 | + 87 |
| Electric refrigerators and parts | 5,124 | − 2,526 |
| *From U.K.* | 2,385 | − 131 |
| *,, U.S.A.* | 2,654 | − 2,288 |
| Ceiling fans | 2,502 | + 701 |
| *From U.K.* | 2,035 | + 700 |
| *,, India* | 452 | + 102 |
| Table fans | 889 | − 638 |
| *From U.K.* | 506 | − 360 |
| *,, Japan* | 254 | − 259 |
| Other electric fans | 236 | − 110 |
| *From U.K.* | 169 | − 89 |
| *,, Netherlands* | 35 | − 15 |
| Flat irons | 368 | − 308 |
| *From U.K.* | 357 | − 500 |
| Accumulators | 2,417 | − 361 |
| *From U.K.* | 1,652 | − 815 |
| *,, Germany* | 329 | + 260 |
| *,, Australia* | 412 | + 192 |
| Batteries | 609* | + 322 |
| Ditto for hand flash lamps | 1,241 | − 1,993 |
| *From Canada* | 44 | − 1,506 |
| *,, U.S.A.* | 365 | − 789 |
| *,, Hongkong* | 231 | − 123 |
| *,, U.K.* | 601 | + 430 |
| Transmitters and radio communication apparatus, including radar, excluding valves | 2,094 | − 77 |
| *From U.K.* | 1,891 | + 8 |
| *,, Netherlands* | 75 | − 94 |
| Transmitting and industrial valves | 271* | − 51 |
| Other valves | 280 | − 223 |
| *From U.K.* | 146 | − 104 |
| *,, U.S.A.* | 10 | − 1 |
| *,, Netherlands* | 112 | − 7 |
| Radio and electronic apparatus and accessories | 1,771 | − 245 |
| *From U.K.* | 1,448 | − 157 |
| *,, Netherlands* | 199 | + 71 |
| Telegraph and telephone apparatus other than radio | 6,174* | + 1,423 |
| Electric cooking and heating appliances | 1,666 | + 617 |
| *From U.K.* | 1,576 | + 602 |
| *,, Germany* | 15 | − 23 |

* All or mainly from U.K. † Comparative figures not available.

# South of Scotland Electricity Board

THE appointment of the new South of Scotland Electricity Board, set up under the Electricity Reorganization (Scotland) Act, 1954, was announced by Mr. James Stuart, M.P., Secretary of State for Scotland, on 1st December.

As we reported in our issue of 6th August, Mr. J. S. Pickles, B.Sc., M.I.E.E., becomes chairman and Sir Norman Duke, K.B.E., C.B., D.S.O., M.C., deputy chairman of the new Board. The other appointments now made are two full-time members, Mr. W. Hutton, M.A., LL.B., Comp. I.E.E., and Mr. W. S. Sawtell, M.I.E.E., and five part-time members, Col. J. G. Crabbe, O.B.E., M.C., J.P., Sir John Imrie, C.B.E., M.A., B.Com., J.P., Mr. Jackson Millar, C.B.E., D.L., J.P., Bailie John Sullivan and Sir Ronald J. Thomson, V.L.

Under the provisions of the Electricity Reorganization (Scotland) Act the South of Scotland Electricity Board will take over from 1st April next the functions of the South West Scotland and the South East Scotland Boards and also the functions in the south of Scotland of the British Electricity Authority.

Mr. Hutton has served as deputy chairman of the South West Scotland Electricity Board since its appointment in 1948. From 1932 to 1939 he was town clerk of Kirkcaldy and from 1939 to 1948 senior depute town clerk of Edinburgh. Mr. Hutton was a member of the Local Government and Public Health Consolidation (Scotland) Committee whose work resulted in the passing of the Local Government (Scotland) Act, 1947, and he is the author of the standard exposition of that Act.

Mr. Sawtell, who has served as deputy chairman of the South East Scotland Electricity Board since 1948, was general manager of the Fife Electric Power Co. from 1947 to 1948 and, before that, for twenty-four years, was general manager of the Scottish Southern Electricity Supply Co., Ltd. Earlier, Mr. Sawtell was with Dundee Corporation Electricity Department for a number of years.

Colonel Crabbe has been a part-time member of the South West Scotland Electricity Board since its inception in 1948. He has been a member of the County Council of Dumfries since 1928, convener of Dumfries County Council since 1946 and H.M. Lieutenant of the County of Dumfries since 1949. He joined the Royal Scots Greys in 1912 and served in the 1914–1918 war and during the last war. He is brigadier, Queen's Bodyguard for Scotland, the Royal Company of Archers.

Sir John Imrie was City Chamberlain of Edinburgh from 1926 to 1951. He served as hon. financial officer of the Edinburgh Festival Society from 1945 to 1951 and from 1951 to 1953 he was local government commissioner in Trinidad. He is an ex-president of the Institute of Municipal Treasurers and Accountants and has served on many Government committees. He is also a Governor of Dollar Academy, where he was educated.

Mr. Jackson Millar, a part-time member of the South West Scotland Electricity Board since 1948, is the senior partner of Jackson Millar & Co., engineers, Glasgow. He is chairman of Albion Motors, Ltd., and a director of Leyland Motors, Ltd. He is also a director of several engineering and other companies in the West of Scotland. He is a member of the Executive Committee of the Scottish Council (Development and Industry).

Bailie Sullivan, a part-time member of the British Electricity Authority since 1952, was formerly a member of the South West Scotland Electricity Board (1948–1952). He also serves as a bailie on the Glasgow Town Council and is a member of the Development Commission and of the Committee for Scotland and Northern Ireland of the White Fish Authority. Mr. Sullivan was formerly Scottish trade group secretary of the Transport and General Workers' Union and was chairman of the Scottish Trades Union Congress in 1948.

Sir Ronald Thomson has been a part-time member of the South East Scotland Electricity Board since 1948. He has been convener of the County of Peebles since 1932, is Vice-Lieutenant of Peeblesshire and civil defence controller for the Eastern Zone of Scotland. From 1948 to 1950 he was president of the County Councils' Association, and since 1952 he has been chairman of the Scottish Special Housing Association. He served as a member of the Scottish Rating and Valuation Committee.

*Mr. J. S. Pickles*

*Sir Norman Duke*

*Mr. W. S. Sawtell*

*Mr. W. Hutton*

## B.E.A. CONTRACTS

CONTRACTS have been placed by the British Electricity Authority during the past month for power stations, transforming stations and transmission lines amounting in the aggregate to £1,817,604. The principal contracts include:

Marchwood power station, near Southampton: 11 kV and lower voltage cables.—London Electricity Board.

Castle Donington station, near Derby: Auxiliary power control and instrument cables.—British Insulated Callender's Cables.

Nottingham station: Circulating water tunnel and outfall.—Marples, Ridgway & Partners.

Ocker Hill station, Tipton, Staffs.: Main civil engineering works.—Lehane, Mackenzie & Shand.

Rogerstone station, Mon.: Two 75 MVA 11·8/70·8 kV generator transformers.—C. A. Parsons & Co.

Wakefield station, Yorks.: Foundations for coal handling plant.—M. Harrison & Co. (Leeds).

Bedford 132 kV substation: 132 kV 2,500 MVA switchgear.—A. Reyrolle & Co.

East Yelland substation, near Barnstaple: 132 kV 2,500 MVA switchgear.—British Thomson-Houston Co.

Margam substation, near Swansea: 45 MVA 132/66 kV transformers.—General Electrical Co.

Tir John and Ystradgynlais substation: 132 kV 2,500 MVA switchgear.—Metropolitan-Vickers Electrical Co.

Monk Fryston and Ferrybridge "B": 275 kV and 132 kV overhead lines.—Balfour, Beatty & Co.

Redhouse-Cupar: 132 kV overhead lines.—W. T. Henley's Telegraph Works Co.

## PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

| | |
|---|---|
| ALUMINIUM Ingots | ton £156 0s 0d |
| COPPER, H.C. Electro | ton £272 10s 0d |
| Fire Refined 99·70% | ton £271 0s 0d |
| Fire Refined 99·50% | ton £270 0s 0d |
| COPPER Tubes .. | lb 2s 7½d |
| Sheet .. .. .. | ton £333 5s 0d |
| H.C. wire and strip .. | ton £305 10s 0d |
| LEAD, English .. | ton £103 10s 0d |
| Foreign .. .. | ton £102 0s 0d |
| MERCURY .. .. | flask £110 0s 0d |
| TIN, block (English) .. | ton £715 10s 0d |
| ZINC, G.O.B. Foreign | ton £81 5s 0d |
| Electrolytic .. .. | ton £85 1s 3d |
| BRASS Tubes (solid drawn) .. .. .. | lb 2s 1½d |
| Sheet .. .. .. | ton £268 5s 0d |
| Wire .. .. .. | lb 2s 8⅝d |
| PHOSPHOR BRONZE Wire .. .. .. | lb 4s 1½d |
| PLATINUM .. .. | oz £30 0s 0d |
| RUBBER, No. 1 R.S.S. spot .. .. .. | lb 24½d–24¾d |

# VIEWS on the NEWS

*By REFLECTOR*

I HAVE always doubted whether electric heating was so much more expensive than other methods as most "authorities" seek to show. Electricity consumption appears to be calculated on the basis of continuous heating by a given wattage but it is common practice and common sense to switch off or switch down the heaters when the temperature becomes too high; and, of course, thermostatic control can be applied to many forms of electric heater. The subject is dealt with in a letter to the *Manchester Guardian* in which the writer gives particulars of his own experience of the electric heating of his lounge. He covers the points I have mentioned and also takes into account the saving represented by the non-fouling of the air, in the matter of furniture and decorations. He omits to mention the convenience of electricity, but he says that taking the advantages into account he considers that he can no longer afford to use solid fuel fires for domestic heating and so he is going to use electricity in his living room as well. While agreeing with his views, I hope that he will try to remember the peak; that is still the one drawback to comprehensive electric heating.

* * *

Last week I had occasion to commend a Gas Board for disguising a new works as a block of flats. Now the Northern Gas Board is proposing to go one better by doing away with gasholders in favour of underground storage. It contemplates excavating some rock salt mines near Billingham for the purpose. Although the work would cost something like £100,000, it is said that this would be cheaper than the erection and use of gasholders, even taking into consideration the higher operating costs. Experience has been similar in the case of some underground electric power stations.

* * *

Very commendably, the South Eastern Electricity Board is endeavouring to educate people in the advantages of ring wiring and it is devoting a series of advertisements to this purpose. In the first of these there appears a symbolic builder with the statement:—

> "Said the Builder to the Bride, 'For plenty of electric points at the lowest cost I recommend the ring circuit system of wiring.'"

I wish I could believe that this was a typical builder. So many of his craft are so anxious to save every possible penny that their electrical installations are as meagre as is consistent with what the buyer will stand. Let us hope that the advertisements will make builders think.

* * *

At a time when so much is being said about the employment of elderly people it is worth while to mention instances which come to one's notice. In the *Quarterly News* of W. Canning & Co., Ltd., I came across two items in this class. The first recorded the activities of a lady of almost 78 who was with the company from 1905 until two or three years later and then *rejoined* in 1947 at the age of 70 and is still at work. The other case was that of a man who had lived for a time in New Zealand and asked for a year's leave for the purpose of visiting friends in that Dominion. He wanted an assurance that there would be a job for him when he got back. He is 76.

* * *

Among other interesting articles in the November *Areatopics* (the staff magazine of the North Western Electricity Board) is one on Mr. "Bill" Turley, one of the Board's meter readers who is also a very successful magician. One of his feats is sawing a woman in half with the woman in full view. *Areatopics* says "he is believed to be the only man in Lancashire doing this particular trick successfully." This carries a rather gruesome implication.

* * *

It was decided recently by the Greenock Town Council that tenants of municipal houses who were behind with their rent should be prohibited from installing interior grates and immersion heaters and from building wooden huts in their gardens. According to the *Scottish Daily Express* this was described by a dissident councillor as "cheek and impudence." It certainly seems a little strange that heating and water heating should be banned although I think I can see the idea. Perhaps it is a sign of the times that a proposal to include television aerials in the ban was withdrawn—that would have been going too far.

* * *

Upon the occasion of the launching of the Authority's latest collier the s.s. *James Rowan* (the late Mr. Rowan was general secretary of the Electrical Trades Union) Lord Citrine mentioned that by next year the British Electricity Authority would be the owners of 52 ships. This is a very substantial fleet and one day, if they can be spared from their coal-carrying duties, I would like to see them in review. It would be an imposing sight.

* * *

Encroachment by electricity supply authorities upon what electrical contractors consider to be their own particular field is no new thing. Fifty years ago there appeared a letter in the *Electrical Review* (9th December, 1904) from the manager and secretary of the City of London Electric Lighting Co. (Mr. J. Cecil Bull) replying to a protest by contractors about a letter which the company had sent to its customers. In this case the complaint seems to have been ill-founded. All the company had done (said Mr. Bull) was to offer to inspect and test consumers' fittings. This was really to the contractors' advantage because if fittings were found to be defective it was left to the consumer to call in his own contractor to replace them. The company had "always endeavoured to maintain a strictly impartial attitude towards contractors and to avoid interfering with their legitimate business."

# The Faraday Lecture

## "Courier to Carrier in Communications"

THE first delivery of this session's Faraday Lecture by Mr. T. B. D. Terroni, B.Sc., A.C.G.I., D.I.C., M.I.E.E., took place before the Merseyside and North Wales Centre of the Institution of Electrical Engineers at Liverpool last Monday. A film in colour indicated the theme suggested by the title "From Courier to Carrier" by tracing the development of communications from the tablets inscribed with hieroglyphics conveyed by Egyptian messengers, through beacons and semaphore signalling, to the development of the automatic exchange and the use of carrier cables instead of overhead wires.

The operation of a two-motion selector mounted on a panel fitted with 100 lamps to represent as many switch contacts was displayed with the effect of dialling different numbers. This was followed by a demonstration of a magnetic drum which acted as a storage device. The drum resembled a flywheel with its periphery divided magnetically into numerous discrete magnets, the north-south orientation of which could be altered from right-left to left-right. Numbers dialled into the drum could be reproduced at will, operating a switch that caused it to step as if controlled from a dial. In the exchange of the future the magnetic drum together with its electronic control would perform the duties of at least 10 bays full of switches and relays and at much greater speeds. An important development was the amplifier which, placed at intervals along the line, restored weak speech signals to their original intensity. With increasing demand, the need for economy in cable size suggested the possibility of making a pair of wires carry more than one conversation. This entailed transmitting a broad frequency bandwidth or tone range and conflicted with the use of loading coils, which had been introduced to improve sound intensity at the expense of bandwidth. By removing the loading coils, the system was made capable of handling a very much wider frequency range, but the signals would be much weaker, necessitating more frequent amplifiers.

*Mr. T. B. D. Terroni is manager and chief engineer of the Transmission Division of the Automatic Telephone & Electric Co., Ltd.*

Speech could be shifted to any part of a frequency spectrum by adding a single tone of the correct pitch to the speech in a modulator. Consequently, a pair of wires, along which up to, say, 24 simultaneous conversations could be transmitted, would only entail the shifting of each conversation by an appropriate pitch or frequency so that all the conversations lay alongside each other in the frequency spectrum (the frequency band normally allocated to each one-way speech conversation was 4 kc/s). Thus conversations were stacked up in the available frequency spectrum and multichannel transmission was achieved over one pair of wires or over a radio link, whether there were three or 600 channels (as transmitted over a single coaxial cable pair).

By improving the insulation of the wires higher frequencies could be transmitted on twisted pair cables. To reduce the size still further so as to lessen cost, one wire was placed inside the other to give a coaxial pair, similar to a television lead-in cable. This arrangement now had very small inductance and since the pair was totally enclosed it was almost perfectly screened from any other pair, giving interference-free communication. It was now realized that the simple conception of current flow in "go" and "return" conductors was inadequate since the conductors merely acted as guides for Faraday tubes of force which conveyed the energy by electromagnetic propagation through the medium between the conductors. Therefore the middle conductor could be eliminated and the copper cylinder used to guide the radio waves transmitted. The outer tube could also be dispensed with if the space were replaced by a dielectric rod (which had a dielectric constant different from air).

Thus the cumbersome overhead construction having pairs capable of handling 16 simultaneous conversations and needing two amplifying station buildings every 200 miles had been developed to the next stage of audio cables with thousands of amplifiers situated in two stations. Next we had carrier cables which were much smaller and used one fifth of the number of amplifiers but required 12 amplifier stations. The use of coaxial cables reduced the number of amplifiers to about 1/100th of those required for the audio cable, but 33 amplifier stations would be needed. The waveguide, which was 2in in diameter, required 16 amplifiers with seven intermediate stations for the 200 mile circuit, but would give 100 times the number of circuits in the frequency range 40,000–80,000 Mc/s. The transmission of electromagnetic waves along these pipes required very high frequencies for economical transmission, with amplifiers at reasonable distances such as 25 miles.

Mr. Terroni then referred to MUSA, the multiple unit steerable antenna system which had been used for most telephone conversations between this country and the U.S.A. with considerable success for 15 years. At frequencies in the microwave or centimetre range, transmission was only possible *via* direct beam, as with light, and apparatus became much smaller. The much higher frequencies enabled larger bandwidths to be used and this was turned to advantage by employing such means as frequency modulation and pulse modulations to combat the effect of noise and fading.

### Use of Waveguides

The future of microwaves would probably lie in the development of the waveguide which could come into its own when the microwave spectrum had been used to the full on heavily laden routes such as obtained in America, where several tens of thousands of broadband circuit miles were at present in use over microwave radio links. Waveguides might even be used simultaneously for the transmission of power at high voltages for industrial purposes.

A further demonstration, employing a map lighted with lamps along the routes radiating from London to the different Centres of the Institution, displayed the means of selecting alternative routes, with the aid of a magnetic drum when the normal route was blocked by excessive traffic or failure. A main trunk exchange feeding a number of minor exchanges, in turn connected to local exchanges, was compared with a railway system, amplifying stations being analogous to the stoking up of a locomotive. Long

distance communication by radio had its counterpart in aircraft.

Transmission of a number of simultaneous conversations over one circuit was illustrated by a mechanical model, in which three independent conversations were represented by three tubes of running white balls which changed in colour to red, blue and yellow—thus visually segregating the three conversations. The coloured balls were then mixed up and sent down one pipe at the far end of which light filters and detectors sorted out the colours and dispatched the balls through the appropriate channels. An explanation of propagation through the ionosphere with radio waves was accompanied by coloured pictures to show analogies between the processes involved. A radio demonstration showed the directivity of very short waves and the fading effects experienced in the ionosphere.

The lecture ended with a film which traced a telephone call from Birmingham to New York detailing the setting up of the call and the route taken by the signals through exchange buildings, apparatus rooms and radio stations.

# Manchester–Sheffield Electrification

THE discussion following the I.E.E. paper on the electrification of the Manchester–Sheffield–Wath railway, which was summarized in the *Electrical Review* of 3rd December, was opened by Mr. C. K. Bird (British Railways) who commented on the gratifying speed with which motor men had picked up the new technique. Average freight speed increased by 25 per cent in September 1954 over September 1953. In one portion of the multiple-unit service both passengers and receipts had increased by over 125 per cent.

Mr. C. M. Cock (English Electric Co.) pointed out that British manufacturers had gained experience all over the world under widely diverse climatic, technical and operating conditions. Manufacturing capacity was ample and could be expanded, if necessary. British Railways might not have sufficient staff numerically, but the services of men of vast experience and knowledge of railway electrification at home and abroad in other organizations could be enlisted. This was the first main-line electrification on which freight traffic predominated, and its success was undoubted, both operational and financial.

Mr. S. B. Warder (British Railways) expressed the view that as much electrification would be done as finance and physical and technical resources would allow. The Institution must help to find young men with imagination and leadership, willing to carve out a career for themselves on the railways.

Mr. O. J. Crompton (British Insulated Callender's Construction Co.) criticized the slowness of the progress in electrification since it was first authorized in 1936, as it was bound to increase costs.

Mr. H. H. Swift (British Transport Commission) thought the film shown to the meeting must lay the bogy that electrification obscured the sight of signals. The scheme was the first to use regeneration and to cope with such extensive colliery subsistence. The introduction of regeneration was largely due to Sir Nigel Gresley who had seen it on a visit to South Africa. In the Southern Region, where conditions were much easier, some tyres had run up to 120,000 to 150,000 miles before being turned. The power supply could best be provided alongside the line as in Holland, where the grid was made up with the idea of supplying the railways. The central-cab type entailed putting the equipment in the sloping ends where the space was restricted. It tended to make the driver's cab noisy and restricted space.

Mr. F. Whyman (Metropolitan-Vickers Electrical Co.) thought tyre turning after 35,000 to 40,000 miles was indefensible on $B_0 + B_0$ locomotives. It meant that one of the main advantages of electrification was being lost.

Mr. E. S. Cox (British Transport Commission) said that traction engineers wanted draw-bar-pull speed curves with contours of rate of current consumption appropriate to the different rates of work. Such values had appeared in recently published reports for steam and diesel locomotives and would be helpful for electric locomotives in dealing with economic motive power, getting away from unsatisfactory calculations and deductions based purely on thermal efficiencies.

The low tyre mileage might be due to tread rather than flange wear and was perhaps connected with unsatisfactory adhesion conditions. All passenger traffic should be run by multiple-unit trains, freight being handled by locomotives specifically designed for that duty without the complications of the steam boiler. This could only occur when the bulk of the lines in this country had been electrified.

Mr. F. H. Bessant (Anti-Attrition Metal Co., Ltd.) was surprised that movements in series or parallel working could not be synchronized between the front and rear of locomotives, possibly by means of electronics. In future designs an attempt should be made to reduce the total tare weight of the motor coach (52 tons). The two electrification schemes completed since the war represented only half of one per cent of the total route mileage of British Railways. This emphasized the development in resources with the introduction of large-scale electrification.

Mr. H. N. Cox asked why the authors had referred to oil-filled 33 kV cable but not the modern gas-pressure type.

Mr. H. Elder (New Zealand Railways) considered that the trend of substation and overhead construction in New Zealand was similar to that in this country. As regards long transmission lines feeding up to substations, a fault on one line in New Zealand was apt to affect both lines. Developments in England seemed to be along modern lines.

Mr. P. Bingley thought the load cycle requirement could have been more simply achieved by specifying B.S. 98, Class 3 loading plus four times the overload for 20 seconds. He showed a slide of a time-limit relay plus an improved instantaneous trip which he was assured would not be costly.

## Dielectric Properties of Wood

Under the above title the Department of Scientific and Industrial Research has recently issued Forest Products Research Special Report No. 8 (H.M. Stationery Office, price 1s 6d). The electrical properties of wood are important in high frequency heating processes, in the use of wood as an insulator and in finding moisture content by electrical means. This report contains the results of work carried out at Princes Risborough on the permittivity and loss tangent of various species of timber. Measurements were made using twelve species of wood. Two timbers are discussed in detail: Sitka spruce, representing medium-light timbers; and oak, representing medium-heavy timbers. The results with other timbers are used to illustrate particular points. Permittivity and loss tangent were measured in the three grain directions at moisture contents up to 18 per cent and over the frequency range from 2 kc/s to 60 Mc/s. Permittivities change uniformly with moisture content and frequency. They are closely related to density and the report suggests a method of predicting approximately the permittivity of any timber. Values for loss tangent vary widely and it is impossible to predict them with any accuracy. Measurements on wet woods showed extremely large variations in permittivity and loss tangent with frequency, but the conductivity depends much less on frequency than it does in dry wood.

# INDUSTRIAL NEWS

## B.I.F. Electrical Section

At the annual meeting of exhibitors in the Electrical Section of the British Industries Fair, Birmingham, last week Mr. W. Percy McGeoch was re-elected chairman and Mr. H. H. Lusty vice-chairman of the committee. The following are represented on the committee:—Bakelite, Ltd., Brook Motors, Ltd., British Electrical Development Association, Clang, Ltd., English Electric Co., Ltd., General Electric Co., Ltd., Higgs Motors, Ltd., Wm. McGeoch & Co., Ltd., Midlands Electricity Board (Birmingham Sub-Area), Permali, Ltd., Tufnol, Ltd., and Westinghouse Brake & Signal Co., Ltd.

The usual overseas publicity campaign to attract buyers to next year's British Industries Fair was launched last week. Press advertising, direct mail, posters, showcards, booklets, a full-scale press service and, for the first time, commercial radio are being used. More than 100,000 invitations, prepared in nine languages, are being sent to addresses in 130 countries, islands and territories overseas. A second two-month mailing programme begins before Christmas and continues until March next year.

## Brussels International Exhibition

The British Government is to participate in the Brussels International Exhibition of 1958. The exhibition will be the largest of its kind ever held on the Continent, and the first major international exhibition for nearly twenty years. It will cover an area of more than 450 acres. Invitations have been sent to fifty-six countries, and acceptances have already been received from America, Canada, Argentina, Norway, the Netherlands, the Vatican City, and many others. Besides an extensive industrial section, there will be an international hall of science. The exhibition will open in mid-April, 1958, and will continue until mid-October.

## Maintaining Hot-Food Temperatures

The difficulty of maintaining hot-food temperatures has been overcome by J. Lyons & Co., Ltd., in two of their Corner Houses, by the use of "Metrovick" infra-red tubular elements. At the Oxford Corner House the "self-service" food counter has the elements installed on the underside of the two upper shelves. These elements, radiating on to the shelf beneath, maintain the hot-food temperature after serving on to the plates, before removal by the customers.

A similar counter has been installed for the "waitress service" at the Strand Corner House. The tubular element is constructed by inserting a magnesium tube of 99·9 per cent minimum purity into an outer sheath of a non-scaling non-corrodible alloy and introducing within the magnesium tube a helical coil of the highest grade heat-resisting wire. The magnesium is then wholly converted by a special process into solidly packed magnesium oxide. The element is designed to operate up to a maximum surface temperature of 750 deg C. Heat regulation is possible by the use of simple control devices.

## Electric Tool Exhibition

The Midlands Electricity Board, in conjunction with Power Tools (B'ham), Ltd., is holding an exhibition of portable and semi-portable electric tools in its industrial showroom, 247, Chester Street, Aston, Birmingham. The exhibition opened on Monday last and will continue until 17th December. A wide range of electrical equipment and accessories is being displayed and demonstrated, and a section of the exhibition is devoted to tools of interest to the home handyman. A special evening session for the amateur will be held on Thursday evening next.

## Scottish Wholesalers' New Premises

The branch premises of Thomson & Brown Brothers, Ltd., an associate of Brown Brothers, Ltd., at Eastgate, Inverness, have for some time past been inadequate and new and larger premises at 55–67, Castle Street, were officially opened on Tuesday last by Mr. J. T. Masterton, managing director. Situated in the centre of the town, the premises comprise three floors. On the ground floor are trade counters, stocks and displays covering the motor, specialized components, tools and garage equipment departments and on the first floor similar facilities for the radio, electrical and cycle departments. The second floor is devoted to accounts and general offices.

## Television in Australia

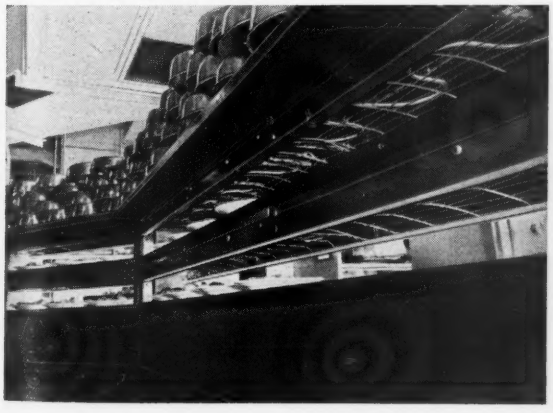
The Government of Australia is to invite tenders for the establishment of television stations in Sydney and in Melbourne. Transmitting and studio equipment required will include film reproduction units, masts, aerials, mobile facilities, etc. Alternative offers will be invited for the supply of equipment only and for the supply and installation of the facilities. The Australian Broadcasting Control Board is shortly to hear applications for commercial television licences.

## Signalling Equipment for S. Africa

The Siemens & General Electric Railway Signal Co., Ltd., has received an order from the South African Railways and Harbours Administration for equipment for the remote control of signals and points at two new crossing loops on the Cape Town–Johannesburg main line. Three diesel-generator sets will be provided for power supplies.

## Eastbourne Teachers' Conference

In continuation of its policy of ensuring that all teachers of domestic subjects in schools and colleges are kept fully informed about new appliances and electrical developments, the South Eastern Electricity Board recently arranged a conference for teachers who work in the districts served by the East Sussex and South West Kent Sub-Area. The conference was held at the Norfolk Hotel, Eastbourne, and delegates were introduced to the latest types of domestic appliances and brief technical details of some of the automatic controls fitted to the appliances were described by the Board's engineers, while the practical uses were explained by demonstrators. Excerpts were given from a selection of films designed as aids to teaching and the morning session closed with a brisk discussion. The afternoon session was mainly occupied by a demon-



*"Metrovick" infra-red tubular elements for maintaining hot-food temperatures*

*Mr. G. H. Ingamells, sub-area commercial engineer, and Miss G. Butt (Weald demonstrator), Seeboard, watch a domestic science teacher removing a meal from the automatic electric cooker*

stration of "Magic in the Kitchen" contributed in an excellent and entertaining manner by Miss Ursula Jackson of Electrolux, Ltd.

## The Iron and Steel Scrap Order

The Minister of Supply (Mr. Selwyn Lloyd), after consultation with the Iron and Steel Board, has made the Iron and Steel Scrap Order, 1954 (S.I. 1954/1593) consolidating the Iron and Steep Scrap (Nos. 1–4) Orders, 1952–54, which are accordingly revoked. The Order removes price control of wrought iron scrap and restricts price control of all other iron and steel scrap to material sold to or bought by consumers. The maximum prices of the better classes of iron and steel scrap have been increased by amounts varying from 2s 6d to 30s per ton. These increases are designed to secure the proper sorting and preparation of scrap by producers and merchants, by providing more adequately for the cost.

## Coal-Face Conveyor Control

A mechanically-operated signalling and motor control unit for coal-face conveyors that does not rely on a battery which could develop a fault has been developed by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. It is fitted with a flameproof pull, latch-out device, mechanically-operated bell, and a winch, all mounted on a steel frame. It can be operated from either side and has no aluminium in its construction.

The pull wire of the unit causes the operating lever to rotate clockwise, thereby simultaneously operating both pull and bell mechanisms. Normally the latching device will come into play and lock out the control circuit; the bell, however, can continue to be worked each time the pull wire is operated. Depression of the latch release bar will restore the trip circuit to normal. If the latch is locked out, the micro-switch contacts in the pull are immediately reset when the rope is released.

The unit is built up on a $\frac{3}{16}$in thick steel base with a carrying handle and a hook at the rear for attachment, by means of a clamp, to the pit-prop or conveyor structure. A hinged cover made of $\frac{3}{32}$in sheet metal and retained by non-loseable screws, encloses and protects the pull and latch mechanism against damage. To protect the winch and operating lever during handling, guard rails are fitted at each side.

## Automatically Operated Door

One of the many smaller innovations of interest introduced at the mills of John Wilson (Gildersome), Ltd., near Leeds, where an extensive modernization programme was carried out by Crompton Parkinson, Ltd., recently, is a simple fractional h.p. motor circuit which permits the ready opening of the sliding doors by a truck operator, necessitating only a momentary pause before the truck can proceed into the storeroom which has to be maintained at an even temperature and free of dust. As can be seen from the accompanying picture, the motor drives a screw which, by means of the travelling nut fixed to the door, opens or closes the latter depending upon which way the motor runs. The circuit consists of two push-button stations — one each side of the door. Also incorporated are two limit switches, a reversing starter, and emergency "stop" buttons.

*An electrically operated door at the mills of John Wilson (Gildersome), Ltd.*

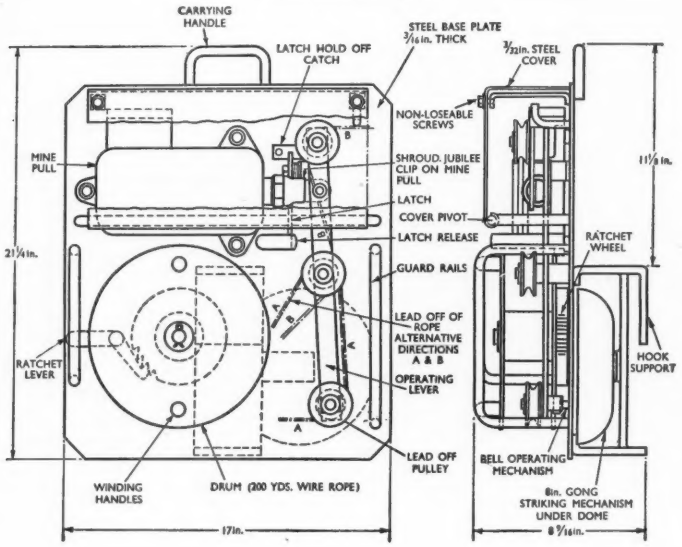
## Glasgow Building Plant Exhibition

The 1955 Building Plant Exhibition, organized by the Ministry of Works, will be held in Glasgow from 8th to 15th June next. The site of the exhibition is on the Queenslie Industrial Estate.

## Japanese Imports

Licences were issued early this year for limited imports in 1954 of certain kinds of "traditional" Japanese exports to the United Kingdom. Interim quotas for 1955 have now been arranged; they have been fixed at half the corresponding 1954 quotas and will be taken into account when considering the question of further imports in 1955. Because many of the licences now to be issued will be small, they will be valid for the whole of 1955 so that they can, if convenient, be held pending the issue of any further licences valid in 1955. The goods involved include battery lamps and parts, £12,500; electric filament lamps, 12 V or less, £7,500; and electric lamps, filament or discharge, 12 V or more, £5,000. Details of the interim quotas and how to apply for licences are given in the Board of Trade's Notic to Importers No. 688.

*Front and side elevation of the new G.E.C. mechanical signalling and motor control unit for coal-face conveyors*




## Farm Electrification

More than thirty members of the staffs of the North Western Electricity Board, the Electricity Board for Northern Ireland and the Isle of Man Electricity Board are to attend a residential course on farm electrification to be held near Preston, Lancs., from 13th to 17th December. The course, which is the second to be organized by the British Electrical Development Association, will be held at the County Institute of Agriculture, Winmarleigh Hall, near Preston, Lancashire. Observers will also be present from the Merseyside and North Wales Electricity Board.

## Purchase Tax on Blanket Covers

As from 1st January purchase tax at a rate of 50 per cent will be chargeable on blanket covers sold separately. Hitherto purchase tax has not been applicable to these covers. It is therefore now cheaper to purchase covers with the electric blankets in which case a tax of 25 per cent is payable.

## E.A.W. Branch Jubilee

The Hartlepools Branch of the Electrical Association for Women celebrated its silver jubilee at a luncheon on 23rd November, when the branch president, Mrs. G. K. Wainwright, J.P., presided. Miss Norah Balls, J.P., E.A.W. chairman, responded to the toast to the Association given by Mr. J. R. Cameron (North Eastern Electricity Board). Among the guests were the Mayor and Mayoress of West Hartlepool, Alderman J. W. Miller, J.P., and Councillor Mrs. Miller; and the Mayor and Mayoress of Hartlepool, Councillor D. Richmond, J.P., and Mrs. Richmond. The toast of

the guests was proposed by Mrs. M. Worthy, branch secretary.

## India Store Department

From 15th December the address of the India Store Department will be Government Building, Bromyard Avenue, Acton, London, W.3 (telephone: Acorn 5353).

## Tinplate Workers' Scholarships

The Court of the Worshipful Company of Tinplate Workers has again decided to offer ten travelling scholarships, each valued at £50, on the same terms and conditions as last year.

## Rotor for Canada

An 80-ton rotor constructed by C. A. Parsons & Co., Ltd., for a power station in Toronto has been shipped from Middlesbrough.

## Electricity in the Navy

The December issue of the *Portsmouth Navy News* contains a two-page illustrated article on the Electrical Branch of the Royal Navy. It traces the origin and history of the Branch and deals at some length with the organization and activities of H.M.S. *Collingwood*, the training establishment at Portsmouth. A later article is to describe the work of H.M.S. *Ariel* which covers the air side of Naval electrical training. The *Portsmouth Navy News* is the official monthly newspaper of the Portsmouth Command and is published by the Navy News Office, R.N. Barracks, Portsmouth, at 3d (postage 1½d).

## Trade Announcements

The address of the Nottingham sales office of **Brook Motors, Ltd.,** is now 14, South Sherwood Street, Nottingham. The telephone number is as before (Nottingham 40184).

The Rectifier Division of **Standard Telephones & Cables, Ltd.,** is moving on 15th December from Warwick Road, Boreham Wood, Herts., to a new factory at Edinburgh Way, Harlow, Essex (telephone: Harlow 26811).

**Clarkson (Engineers), Ltd.,** have opened a Birmingham branch at 15, Heath Mill Lane, Birmingham, 9 (telephone: Victoria 3994).

**Smiths English Clocks, Ltd.,** has moved its Scottish depot to 123–145, North Street, Glasgow, C.3 (telephone: Glasgow Central 3972–8).

The address of Mr. F. E. London, representative for **Venner, Ltd.,** in the North Eastern Electricity Board area, is now 10, Grosvenor Terrace, Bootham, York (telephone: York 3569).

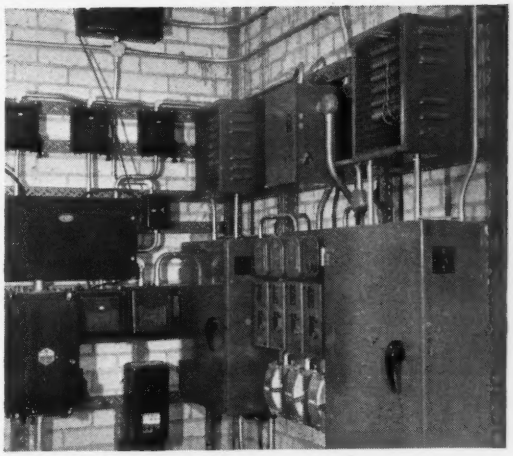
Mr. S. J. Davies has been appointed a technical representative of the **Jackson Electric Stove Co., Ltd.,** attached to the company's Liverpool Branch, covering the Merseyside and North Wales Electricity Board Area. Mr. Davies was formerly with the Birkenhead Corporation Electricity Department and subsequently with the Merseyside and North Wales Electricity Board in the Welsh and Liverpool areas.

The address of Mr. W. Maitland, area engineer in Glasgow for **Wilkinson Rubber Linatex, Ltd.,** is now 66, Woodbank Crescent, Clarkston, Glasgow.

## Slotted Angle Bar

Advantages of slotted angle bar are speed and economy of installation, and its use by unskilled labour is restricted only by the necessity of accurate cutting to ensure correct matching of the slots for bolting.

At a recent demonstration given in London by Chevron Structural Units, Ltd., it was claimed that this remaining restriction had now been eliminated with the introduction of their latest product, "Chevron" angle bar. By an ingenious pattern of slots, based on a geometrical arrangement, it is possible to cut and join the bar anywhere without the risk of blind spots and a bolting position is always available. Made in 14-gauge cold rolled steel it is available in two sizes, 2in by 2in and 3in by 2in, for medium and heavy duty. "Chevron" is now in full production and its adaptability is demonstrated in a range of applications at the company's showroom, 7, Victoria Street, London, S.W.1.



*A typical switchgear installation mounted on a framework of "Chevron" slotted angle bar*

## CATALOGUES & LISTS

**ACCESSORIES.** — 76-page illustrated priced catalogue covering the 1955 range of "M.K." electrical accessories. M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, London, N.18.

**CONDUIT FITTINGS.**—Price list of "Blaco" conduit fittings, switch boxes, junction boxes, etc.—F. C. BLACKWELL & CO., LTD., Great Crosby, Liverpool, 23.

**CONTROL GEAR.**—Catalogue describing the full range of the company's control gear, together with a short introductory booklet.—G.W.B. FURNACES, LTD., Dibdale Works, Dudley, Worcs.

**DOMESTIC EQUIPMENT.**—Illustrated priced broadsheet of Hotpoint electric domestic appliances.—HOTPOINT ELECTRIC APPLIANCE CO., LTD., Crown House, Aldwych, London, W.C.2.

Illustrated leaflet covering a range of domestic electric fires.—FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.

**ELECTROPLATING.**—Five leaflets covering the range of Canning metal cleaners for the electroplating and metal finishing industries.—W. CANNING & CO., LTD., Great Hampton Street, Birmingham, 18.

**LIGHTING FITTINGS.**—Leaflet dealing with the application of "Linolite" system of strip lighting to domestic, commercial and industrial lighting scheme.—LINOLITE, LTD., 118, Baker Street, London, W.1.

64-page illustrated catalogue covering the company's range of "Ultralux," "Versalite," and "Mondolite" fittings.—TROUGHTON & YOUNG (LIGHTING), LTD., 143, Knightsbridge, London, S.W.1.

Catalogue LF5 illustrating the 1955 range of "Dexray" lighting fittings.—DEXRAY ENGINEERING CO., LTD., 34, Ardwick Green South, Manchester, 15.

16-page illustrated priced catalogue of modern interchangeable fittings.—GEO. FORREST & SON, LTD., 30, Osborne Road, London, W.3.

54-page illustrated priced catalogue on commercial and industrial lighting (460/55).—WHOLESALE FITTINGS CO., LTD., 46–52, Commercial Street, London, E.1.

Priced leaflet on "Cryselco" benchlight fittings for mains or low voltage lighting.—CRYSELCO, LTD., Lighting Department, Kempston Works, Bedford.

Illustrated priced catalogue on decorative lighting fittings for ships.—GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.

**MAGNETIC SEPARATORS.** — Two publications (PM47 and PM48) on permanent magnetic separators.—ELECTROMAGNETS, LTD., Bond Street, Birmingham, 19.

**MAINS FAILURE ALARM.**—Descriptive leaflet on the Gent's battery operated mains failure indicator.—GENT & CO., LTD., Faraday Works, Leicester.

**RESISTANCE MATERIALS.**—Technical leaflet on oxy-insulated "Brightray B," a special finish for wire-wound resistances.—HENRY WIGGIN & CO., LTD., Wiggin Street, Birmingham, 16.

**TRANSFORMERS.**—Booklet on the company's new range of Green Seal Class "H" transformers. — BRENTFORD TRANSFORMERS, LTD., Kidbrooke Park Road, London, S.E.3.

**VALVE RETAINERS.**—First issue of the Electrothermal valve retainer data booklet.—ELECTROTHERMAL ENGINEERING, LTD., 270, Neville Road, London, E.7.

**VOLTAGE REGULATORS.** — 32-page illustrated catalogue describing moving coil voltage regulators for transmission, distribution and industry (TS.MCVR/1/54).—FERRANTI, LTD., Hollinwood, Lancs.

## TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 24th December:—

KRONPRINZ. No. 714,074, Class 9. Fittings for h.v. electrical apparatus and instruments; and electric conduits of armoured steel tubing. —Kronprinz Akt.-Ges., Solingen-Ohligs, Germany. Address for service, c/o Lloyd Wise, Bouly & Haig, 10, New Court, Lincoln's Inn, London, W.C.2.

DYNAMASTER. No. 729,163, Class 9. Apparatus and instruments for use in controlling, indicating, recording and measuring electrical values, pressure, temperature, rate of flow of liquids and gases, liquid level, draught, humidity and pH value; and parts.—Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset.

TRUMOD. No. 733,884, Class 9. Instructional and teaching apparatus; scientific apparatus; and electrical apparatus and instruments.—Teebee Manufacturing Co., Ltd., 205, Hook Road, Surbiton, Surrey.

VISCOUNT. No. 734,087, Class 9. Radio receiving and transmitting apparatus; sound reproducing, recording and transmitting apparatus, vacuum cleaners, electric flat irons and domestic electric utensils.—R. N. Fitton, Ltd., Princess Works, Princess Street, Brighouse, Yorks.

# NEW BOOKS

**Transient Analysis of Alternating Current Machinery.** By Waldo V. Lyon. Pp. 310; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 56s in the United Kingdom.

Except to the experienced machine designer the transient analysis of a.c. machinery has always been regarded as one of those very advanced studies which are either difficult to bring to a realistic conclusion or in which one must make so many simplifying assumptions in order to arrive at a solution expeditiously as to cast some doubt upon the final results. Mostly, the investigator has relied upon the operational calculus and the Laplace transform as his working tools although, as a perusal of the journals of the engineering institutions issued within the last ten years show, there has been a steady incline towards the use of symmetrical component theory for the purpose. In the present book the symmetrical component method reaches mature fruition and it is the basis of the entire work.

The broad plan of the book is as follows. The analysis is based on the Kirchhoff differential equations of the machine and the connected system and if the equations are linear with constant coefficients, their solution is obtained by substitution in a general formula. Substitution of the symmetrical components of the instantaneous potentials and currents in the Kirchhoff equations for the actual potentials and currents permits the equations to be separated into positive sequence and negative sequence equations. The relations between the component equations are determined by the conditions at the stator and rotor terminals, and machines with uniform air gaps and those with salient poles are both dealt with. The equations are generalized by using the per unit system and all results are expressed by measurable quantities. The direct axis and the quadrature axis components and the forward and backward components can be derived directly from the symmetrical components.

Induction and synchronous machines with constant and variable speed are covered and the various circumstances which can set up transient conditions in the machines are well chosen and essentially practical.

The book contains the general analysis of about sixty typical problems given in detail in such a form that numerical values of the system constants can be substituted for any particular case. In addition there are about forty numerical examples, all of which are of considerable value in helping the reader to follow the arguments. The work should be welcome to rotating machine designers, power and system engineers, teachers and students alike and to them we fully recommend it.

**Fundamentals of Electrical Engineering.** By Edward Hughes, D.Sc.(Eng.), Ph.D., M.I.E.E. Pp. 470; figs. 311. Longmans, Green & Co., Ltd., 6 and 7, Clifford Street, London, W.1. Price 12s 6d.

This book is a sequel to "Principles of Electricity in M.K.S. Units" written by Dr. Morley in collaboration with the present author which has already been reviewed in these pages. That book, it may be recalled, was for first and second year students and now the present volume, which is also based on the rationalized m.k.s. system, is for senior students covering the third year course for the Ordinary National Certificate in Electrical Engineering.

For the convenience of students, before the first chapter a list of symbols and abbreviations covering four pages is given, being based upon the recommendations of the British Standards Institution and the Institution of Electrical Engineers, and these are used throughout. Thence, having dealt with the fundamentals of the electric circuit, electromagnetism and electrostatics, all the various types of d.c. and a.c. machines as well as transformers, electronic valves and rectifiers are discussed and the work closes with a chapter on symbolic notation, the intention being that the student should not be introduced to the symbolic method until he has had a thorough grounding in the use of vector diagrams. As a further aid, worked examples are incorporated in the text where necessary together with a set of appropriate problems (with numerical answers) at the end of each chapter, these having been taken from examination papers set by London University, the Institution of Electrical Engineers and kindred examining bodies.

Dr. Hughes is to be congratulated on the production of a book which should do much to overcome the difficulties not only of the student but of the more mature engineer in the application of mathematical theories to electrical science.—A.R.

**Lighting for Color and Form.** By R. G. Williams. Pp. 340 + xvi; figs. 134. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 45s.

The author's name is still well known to lighting engineers in this country, although for some time now he has exercised his flair for spectacular lighting on the other side of the Atlantic. The present book is, to a large extent, based on the author's practical experience in this field; it is pleasantly and convincingly written and is a welcome successor to "The Technique of Stage Lighting."

Of the four parts into which the book is divided, the first deals with underlying principles and the author has wisely confined himself to a fairly general treatment in language which the "layman" can easily understand (although he is clearly not very happy when dealing with the geometry of the chromaticity diagram). The second part contains a wealth of information on light sources, filters, the many types of equipment available for stage and spectacular lighting and, finally, dimmers and control apparatus. In the third part the author discusses what he terms the psychological and æsthetic factors in lighting, while the last part, entitled "Lighting Application Techniques," contains chapters on such subjects as shop window and display lighting, studio lighting, architectural lighting, etc.

It might, perhaps, be surprising that a book printed and published in this country should adopt a number of Americanisms, both of spelling and of terminology, and draw so largely on American sources for its illustrations, were it not for the fact mentioned at the beginning of this review. The production is of a very high standard.—J.W.T.W.

**Electricity Undertakings in Natal** (Vol. V of Natal Regional Survey). Pp. 100; 21 figs. and two illustrations. Oxford University Press (London: Geoffrey Cumberlege), Amen House, Warwick Square, E.C.4. Price in the United Kingdom 25s.

The survey of which this is a part was carried out by the University of Natal on the invitation of the Social and Economic Planning Council. This part gives a general survey of the economic aspects of electricity generation, transmission and distribution, with special reference to Natal. The rest of the volume, about three-quarters, deals in considerable detail with the individual undertakings and particularly the Natal Central and Durban systems.

An interesting feature is the inclusion of particulars of the tariffs of the various undertakings. A separate chapter dealing with rural electrification is a study of the comparative costs and values of electrical and other methods to the farmer.—J.H.C.

## BOOKS RECEIVED

**Electronic Measuring Instruments.** By Major E. H. W. Banner, M.Sc., M.I.E.E., M.I.Mech.E., F.Inst.P., M.Cons.E. Pp. 395; figs. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 45s.

**Textbook of Illuminating Engineering.** By J. W. T. Walsh, O.B.E., M.A., D.Sc. Pp. 202; figs. 137. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 28s.

# NEXT WEEK'S EVENTS

*Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged*

**Monday, 13th December**

BIRMINGHAM.—Grand Hotel, Colmore Row, 6.15 p.m. Birmingham Electric Club. "The B.R.M. and Racing Car Design," by P. Berthon.

BRISTOL.—S.W.E.B., Colston Avenue, 6 p.m. I.E.E. Western Centre. "The Possibilities of a Cross-Channel Power Link between the British and French Supply Systems," by D. P. Sayers, M. E. Laborde and F. J. Lane.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Safety in the Use of Portable and Transportable Electrical Equipment in Industry," by J. W. Bunting.

DUNDEE.—Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. "Feedwater Treatment," by E. L. Streatfield.

IPSWICH.—Electric House, 7.30 p.m. Ipswich & District Electrical Association. Film night.

LEEDS.—24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. "X-Ray Apparatus for Medical Applications," by F. L. Veale.

LEICESTER.—Demonstration Theatre, Electricity Offices, Charles Street, 7 p.m. Leicester Electrical Society. "Safe Use of Portable Apparatus," by S. J. Emerson and "Precautions in Radio and TV Test Departments," by A. S. Carr.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. Discussion on "Practical and Economic Problems in the Maintenance of Domestic Television Receivers," opened by W. L. Greenwood.

St. Ermins Hotel, Caxton Street, 7 p.m. A.S.E.E. Central London Branch. "Atomic Energy," by R. A. Dixon.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Short-Circuit Forces on Turbo-Alternator End Windings," by J. B. Young and D. H. Tompsett.

SHEFFIELD.—The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. Presidential address, by E. C. Lennox.

Livesey Clegg House, 7.30 p.m. Junior Institution of Engineers, Sheffield & District Section. "Post-War Developments in Coal Face Machinery," by S. McCallum.

STONE.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Aluminium-Sheathed Cables," by P. M. Hollingsworth and P. A. Raine.

**Tuesday, 14th December**

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. "The Possibilities of a Cross-Channel Power Link between the British and French Supply Systems," by D. P. Sayers, M. E. Laborde and F. J. Lane.

COVENTRY.—Electricity Sports & Social Club, Merrick Lodge, St. Nicholas Street. Coventry Electric Club. Electrical "quiz."

EDINBURGH.—11, Atholl Crescent, 7.30 p.m. Edinburgh Electrical Society. "Lighting Equipment and Schemes," by R. W. Lawrence.

GLASGOW.—425, Sauchiehall Street, 7 p.m. Institution of Heating and Ventilating Engineers, Scottish Branch. "Corrosion in Small Boilers," by J. C. Stainton.

HUDDERSFIELD.—Y.E.B., Market Street, 7 p.m. I.E.E. North Midland Students' Section. "Electrical Distribution Practice in Germany," by P. H. Sinclaire.

KIDDERMINSTER.—At the Victoria Carpet Works, 7.30 p.m. Institute of Industrial Supervisors, Kidderminster Section. "Electronics," by E. Britton.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Education Discussion Circle. Discussion on "The Place of Electrical Network Theory in Electrical Courses," opened by Dr. G. S. Brayshaw.

LIVERPOOL.—College of Art, Hope Street, 7 p.m. I.E.S. Liverpool Centre. "Stage Lighting," by P. Corry.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Measurements Section. "An Attracted-Disc Absolute Voltmeter," by G. W. Bowdler, "The Use of an Electron Velocity Analyser to Stabilize a 50 kV d.c. Voltage Source to a few parts in a Million," by M. E. Haine and M. W. Jervis, and "A Precision Direct-Current Stabilizer," by M. W. Jervis.

2, Savoy Hill, 6 p.m. Illuminating Engineering Society. "Maintenance of Lighting Installations," by J. Mortimer Hawkins, W. Robinson and J. W. Strange.

Connaught Rooms, Great Queen Street, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Speaker, Mr. Tom Fallon.

MANCHESTER. — Engineers' Club, Albert Square, 7.15 p.m. Incorporated Plant Engineers, Manchester Branch. "Fire Protection in Peace and War," by K. N. Hoare. (Joint meeting with the Institution of Fire Engineers.)

Engineers' Club, 7 p.m. A.S.E.E. Manchester Branch. Ramsey Regional Lecture: "Electrical Generation by Wind Power," by Lord Verulam.

NEWPORT.—Flying Services Club, 28, High Street. Newport & District Electric Club. "Further Naval Manœuvres," by Comm. R. Walker, R.N. (Retd.)

SWANSEA.—Mackworth Hotel, 7.15 p.m. Incorporated Plant Engineers, South Wales Branch. "Vacuum and Air in Industry."

**Wednesday, 15th December**

CHELMSFORD.—Public Library, 7 p.m. I.E.E. London Students' Section, district meeting. "Machines, Animals and Information," by B. Z. de Ferranti.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Servo Machines," by W. S. Wood.

425/427, Sauchiehall Street, 7 p.m. Incorporated Plant Engineers, Glasgow Branch. "Steam for Process," by L. G. Northcroft.

LEEDS.—Hotel Metropole, 7.30 p.m. Institution of Heating and Ventilating Engineers, Yorkshire Branch. "Fuels for the Smaller Boiler Plant," by H. Pollard and B. Stonham.

LINCOLN.—Technical College, 7.15 p.m. I.E.E. East Midland Students' Section. "The Development of Precision Electric Clocks," by P. Harvey.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Supply Section. "Short-Circuit Forces on Turbo-Alternator End Windings," by J. B. Young and D. H. Tompsett.

Pepys House, 14, Rochester Row, 6.30 p.m. Institution of Heating and Ventilating Engineers, London & District Associate Members' & Graduates' Section. "Recent Developments in Heating, Cooling and Ventilation at Atomic Energy Research Establishments," by G. M. Harbert and J. Ferguson.

NOTTINGHAM.—E.M.E.B., Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. American industrial films.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "Some Design Features of the Semi-Outdoor Power Station at Ince," by F. H. S. Brown.

SOUTHAMPTON.—Polygon Hotel, 8.15 p.m. A.S.E.E. Southampton Branch. "Sound Recording on Disk and on Magnetic Tape," by J. F. Doust.

SUTTON COLDFIELD.—Town Hall, 8 p.m. I.E.E. South Midland Students' Section. Joint dance.

WIMBLEDON.—Guild House, 32, Worple Road, 8.15 p.m. A.S.E.E. South West London Branch. "Modern Lighting Technique," by R. Pye.

**Thursday, 16th December**

BIRMINGHAM.—Imperial Hotel, 6.30 p.m. Institution of Heating and Ventilating Engineers, Birmingham & District Branch. "Social and Industrial Consequences of the Presence of Sulphur in Fuels," by Dr. A. Parker. (Joint meeting with the Institute of Fuel, Midland Section.)

BLACKBURN.—Golden Lion Hotel, 7.30 p.m. Incorporated Plant Engineers, Blackburn Branch. "Lighting," by Mr. Robinson.

CHELMSFORD.—Crompton Parkinson's Social Centre, 7.30 p.m. Chelmsford Engineering Society. "The Contribution of Twentieth Century Science to Modern Thought," by Sir Henry Self.

DUBLIN.—Trinity College, 6 p.m. I.E.E. Irish Branch. "The New Cork Power Station—Mechanical and Electrical Plant," by H. Monroe and C. V. O'Donnell.

LIVERPOOL.—Radiant House, Bold Street, 7.15 p.m. Incorporated Plant Engineers, Merseyside & N. Wales Branch. "Progress in Lamps and Lighting," by R. V. Mills.

LONDON.—Caxton Hall, S.W.1, 2.30 p.m. Diesel Engine Users' Association. Annual meeting.

NOTTINGHAM.—Albert Hall, 7.15 p.m. I.E.E. East Midland Centre. Faraday Lecture: "Courier to Carrier in Communications," by T. B. D. Terroni.

SOUTHAMPTON.—Polygon Hotel, 7 for 7.30 p.m. I.E.E. Southern Centre. Annual dinner and dance.

WATFORD.—Clarendon Hotel, Station Road, 8 p.m. A.S.E.E. Watford Branch. "Industrial, Electrical and Mechanical Repairs," by H. Westwood.

**Friday, 17th December**

LEEDS.—Griffin Hotel, 8 p.m. I.E.E. North Midland Students' Section. Joint dance with the Institutions of Civil and Mechanical Engineers.

LONDON.—Windsor Castle Hotel, Victoria, S.W.1, 6.30 for 7 p.m. Electrical Trades' Commercial Travellers' Association. Annual "stag party," dinner and smoking concert.

MANCHESTER. — Engineers' Club, Albert Square, 6.30 p.m. Institution of Heating and Ventilating Engineers, Manchester & District Branch. "Some Aspects of Atmospheric Pollution and the Soiling of Textiles," by W. H. Rees.

NEWCASTLE-UPON-TYNE. — Incorporated Plant Engineers, North-East Branch. Annual dinner.

**Saturday, 18th December**

MANCHESTER. — College of Technology. Manchester Association of Engineers. Christmas conversazione and dance.

OXFORD.—Y.M.C.A., 10, George Street, 6.30 p.m. A.S.E.E. Oxford Branch. "Earth Leakage Protection," by J. A. Robbins.

## FORTHCOMING EXHIBITIONS

British plastics manufacturers have over-applied for space in the third biennial British Plastics Exhibition, to be held at Olympia, London, from 1st to 11th June next. There will be nearly 100 exhibitors. The Convention will be held from 2nd to 9th June. The Exhibition is being organized by *British Plastics*, Associated Iliffe Press, Dorset House, Stamford Street, London, S.E.1, with the full co-operation of the British Plastics Federation.

The dates previously announced for the International Machine Tool Exhibition to be held at Olympia, London, in 1956 have been altered. The exhibition, organized by the Machine Tool Trades Association, will now take place from 22nd June to 6th July. This is a week later than originally planned.

## *Financial Section*

# STOCKS and SHARES

BY the beginning of this week, Stock Exchange markets were emerging, a little shaken, from a flurry of anxiety over the possibility of an increase in Bank Rate. Detecting symptoms of incipient inflation in the economy, some financial observers have been advocating a mildly corrective dose of dearer money. They were evidently listened to with respect in some quarters, for at one time last week War Loan had lost two full points, and recovered only half the loss in the subsequent rally. Industrial shares dipped in sympathy, but a good dividend and preliminary profits statement from Turner & Newall helped to put fresh heart into the "blue-chip" industrials.

### Turner & Newall

A rise of nearly 6s to 98s 9d in the price of Turner & Newall £1 shares gives the measure of market satisfaction with the declaration of a final dividend making a total of 22½ per cent (or 5 per cent more than last year's) for the twelve months ended last September. Group trading profits for this period come out much as before, but a smaller tax charge (thanks, it is supposed, to relief from the excess profits levy) leaves the net surplus some £800,000 higher at £5·3 million. There is still practically four-fold cover for the new rate of ordinary dividend, on the basis of which the shares at their present price offer a yield of a little over 4½ per cent.

### Siemens and A.E.I.

Siemens Bros. £1 ordinary were marked up by 3s 6d to 42s 6d (after changing hands up to 44s) pending further news of the offer for the stock expected to come from Associated Electrical Industries,Ltd. Stockholders were advised not to deal in their stock until they had additional information. A.E.I. already have a large interest in Siemens through their purchase, three years ago, of £450,000 ordinary stock from the Custodian of Enemy Property. This deal was said at the time to have as its objective the extension of A.E.I.'s comparatively limited interests in such branches of electrical engineering as telephone equipment and cable manufacturing.

### Enfield Cables

In announcing the appointment of Sir John Black (formerly of Standard Motors) as deputy-chairman of the company, Enfield Cables issued an interim trading report in which an ordinary dividend payment for the present year is said to be unlikely. Following a substantial loss for the first half of this year, however, the various measures initiated to rectify the position are reported to have begun to show results. Little if any loss is anticipated for the second six months, and the improvement should be maintained and extended next year. This report bears out the forecast of events

## *The Week's Price Changes*

| Company or Board | Nom. Value | Middle price 6th Dec. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % | 1954 Highest | 1954 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Gilt-edged Stocks* | | | | | | £ s d | | |
| Brit. Elec. 1968/73 ... ... | 100 | 96 | −1 | 3 | 3 | 3 2 6 | 97 | 88⅞ |
| Brit Elec. 1974/77 ... ... | 100 | 95½ | −½ | 3 | 3 | 3 2 10 | 96½ | 87½ |
| Brit. Elec. 1976/79 ... ... | 100 | 100½ | −½ | 3½ | 3½ | 3 9 8 | 101½ | 93 5/16 |
| Brit. Elec. 1974/79 ... ... | 100 | 110 | −½ | 4½ | 4½ | 3 17 3 | 111½ | 103 3/16 |
| *Overseas Electric Supply* | | | | | | | | |
| Calcutta Elec. ... ... ... | £1 | 22/6 | +1/- | 6† | 6† | 5 6 8† | 24/6 | 18/7 |
| East African Power ... ... | £1 | 22/6 | | 7 | 7 | 6 4 6 | 23/4 | 19/6 |
| Nigerian Elec. ... ... ... | £1 | 24/- | | 10 | 10 | 8 6 8 | 25/- | 23/6 |
| Palestine Elec. "A" ... ... | £1 | 21/- | | Nil | Nil | — | 21/- | 16/- |
| Perak Hydro-Elec. ... ... | £1 | 18/- | | 6 | 10 | 11 2 3 | 20/- | 13/9 |
| *Equipment and Manufacturing* | | | | | | | | |
| Aberdare Cables ... ... ... | 5/- | 13/- | −9d | 25 | 12½* | 4 16 2 | 14/3 | 8/1 |
| Aerialite ... ... ... ... | 1/- | 12/3xd | | 88½ | 88½ | 7 4 3 | 14/6 | 10/9 |
| Allen, W. H. ... ... ... | £1 | 78/3 | | 15 | 20 | 5 2 3 | 78/6 | 50/- |
| Aron Elec. Ord. ... ... ... | £1 | 60/- | | 20 | 15 | 5 0 0 | 60/- | 43/- |
| Assoc. Elec. Ord. ... ... ... | £1 | 60/9 | | 20 | 11½* | 3 14 0 | 62/6 | 41/6 |
| Automatic Tel. & El. ... ... | £1 | 70/- | | 15 | 15 | — | 73/- | 57/3 |
| Babcock & Wilcox ... ... ... | £1 | 73/3 | | 18 | 12* | 3 5 6 | 76/3 | 47/3 |
| Baldwin, H. J. ... ... ... | 2/- | 4/9 | | 20 | 20 | 8 8 6 | 5/6 | 3/9 |
| Bakelite ... ... ... ... | 10/- | 30/- | −1/3 | 12½ | 12½ | 4 3 4 | 32/- | 23/6 |
| British Aluminium ... ... | £1 | 38/9 | | 12 | 10 | 5 3 1 | 40/- | 33/9 |
| B.I. Callender's ... ... ... | £1 | 48/9 | −9d | 10 | 10 | 4 2 0 | 52/- | 37/9 |
| B.I. Callender's 6% Pref. ... | £1 | 26/3xd | | 6 | 6 | 4 11 6 | 26/6 | 24/3 |
| British Thermostat ... ... | 5/- | 26/3 | −9d | 35 | 27½* | — | 28/- | 12/- |
| British Vac. Cleaner ... ... | 5/- | 13/9 | | 15 | 25 | 9 1 10 | 14/6 | 11/6 |
| Brook Motors ... ... ... | 10/- | 43/9xd | | 20 | 20* | — | 45/6 | 29/3 |
| Brush Ord. ... ... ... | 5/- | 7/9 | | 4 | 6 | 3 17 3 | 8/3 | 3/6 |
| Bulgin, A. F. ... ... ... | 1/- | 4/3 | | 30 | 30 | 7 1 3 | 4/3 | 3/2 |
| Burco ... ... ... ... | 5/- | 19/6 | −3d | 35 | 25* | 6 8 3 | 20/- | 12/1 |
| Chloride El. Storage "A" ... | £1 | 67/6 | −6d | 20 | 12½* | 3 14 0 | 68/6 | 46/6 |
| Clarke Chapman ... ... | £1 | 70/- | +1/9 | 17½ | 20 | — | 73/- | 47/6 |
| Cole, E. K. ... ... ... | 5/- | 18/- | | 25 | 27½ | — | 19/6 | 11/6 |
| Cossor, A. C. ... ... ... | 5/- | 9/6 | | 10 | 10 | 5 5 3 | 11/- | 7/- |
| Crabtree ... ... ... ... | 10/- | 31/6 | | 17½ | 20 | 6 7 0 | 32/- | 23/9 |
| Crompton Parkinson Ord. ... | 5/- | 21/3 | | 20 | 20 | 4 14 3 | 22/- | 14/- |
| De La Rue ... ... ... ... | 5/- | 21/- | +1/6 | Nil | 20 | 4 15 3 | 21/6 | 12/3 |
| Decca ... ... ... ... | 4/- | 48/6 | −1/- | 150 | 35* | — | 51/3 | 32/- |
| Desoutter ... ... ... ... | 5/- | 25/- | | 18 | 20 | 4 0 0 | 25/- | 16/1 |
| Dewhurst ... ... ... ... | 2/- | 7/-xd | | 19 | 24 | 6 17 3 | 7/- | 5/1 |
| Dictograph Tel. ... ... ... | 2/- | 6/9 | −3d | 20 | 20 | 5 18 4 | 8/- | 5/2 |
| Dubilier Condenser ... ... | 1/- | 4/6 | | 25 | 25 | — | 5/3 | 3/3 |
| E.M.I. ... ... ... ... | 10/- | 21/6 | −2/- | 8 | 10 | 4 13 0 | 24/- | 11/3 |
| Electrical Components ... ... | 5/- | 16/3 | | 20 | 20 | 6 3 0 | 16/3 | 10/9 |
| Elec. Construction ... ... | £1 | 70/- | +1/3 | 15 | 15 | 4 5 9 | 70/- | 53/- |
| Enfield Cable Ord. ... ... | £1 | 24/6 | −6d | 5 | Nil | Nil | 26/3 | 16/6 |
| English Electric ... ... ... | £1 | 56/3 | −1/3 | 15 | 10* | 3 11 0 | 59/- | 38/- |
| English Electric 3½% Pref. ... | £1 | 16/9 | | 3½ | 3½ | 4 9 7 | 16/9 | 15/3 |
| Ericsson Tel. ... ... ... | 5/- | 32/3 | +1/- | 22† | 25† | 1 18 6†= | 33/9 | 22/9 |
| Ever Ready ... ... ... | 5/- | 24/- | −1/- | 35 | 40 | — | 26/3 | 27/9 |
| Falk Stadelmann ... ... ... | £1 | 45/9 | +2/9 | 15 | 15 | 6 11 3 | 45/9 | 36/6 |
| G.E.C Ord. ... ... ... | £1 | 58/3 | −1/9 | 11½ | 12½ | 4 5 9 | 60/- | 37/6 |
| G.E.C. 6½% Pref. ... ... | £1 | 28/9 | | 6½ | 6½ | 4 10 6 | 28/9 | 26/6 |
| General Cables ... ... ... | 5/- | 17/9 | | 30 | 30 | 8 9 0 | 18/- | 16/3 |
| Greenwood & Batley ... ... | £1 | 55/- | | 17½ | 17½ | 6 7 3 | 55/- | 40/3 |
| Hackbridge Cable ... ... | 5/- | 14/9 | | 20 | 20 | 6 15 6 | 15/9 | 11/3 |
| Hackbridge & Hewittic ... ... | 5/- | 25/-xd | | 20 | 25 | 5 0 0 | 25/- | 16/10 |
| Hall Tel. Acc. ... ... ... | 10/- | 12/6 | | 10 | 10 | 8 0 0 | 13/- | 10/6 |
| Heatrae ... ... ... ... | 2/- | 5/3 | −3d | 12½ | 12½ | 4 11 0 | 5/6 | 4/- |
| Henley's ... ... ... ... | 10/- | 18/6 | −1/- | 10½ | 10½ | 5 13 6 | 22/- | 15/6 |
| Holophane ... ... ... | 5/- | 17/6 | −6d | 20 | 25 | 7 2 9 | 18/- | 13/1 |

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

made at the annual meeting in June, when references were made to the sale of the company's unprofitable rubber investment to Dunlops for £750,000, and the plans for a major reorganization of the cable business. The £1 shares were called 24s 6d in the market after the announcement.

### Pye Capital

The Pye company proposes to raise £1½ million new capital by the issue of a million 5½ per cent second preference shares, and of more 5s "A" deferred shares to make up the balance. Terms of the offers are to be decided later. When raising some £700,000 by an issue of shares in July last, the company advised stockholders that more working capital would probably be needed in the course of the next few years. Although coming so closely on the heels of that issue, the new proposals unsettled only momentarily the market in the shares, which later turned distinctly firm. Acquisitions to be financed by the new money are calculated to make certain of the supply of certain components and to contribute at least £250,000 to group profits in their first full year of operation.

## *in Electrical Investments*

| Company or Board | Nom. Value | Middle price 6th Dec. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % £ s d | 1954 Highest | 1954 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Equipment and Manufacturing—continued.* | | | | | | | | |
| Hoover | 5/- | 45/3 | | 25 | 45 | 4 19 6 | 51/- | 26/3 |
| I.C.I. | £1 | 40/6 | | 13 | 15 | 3 14 3* | 43/6 | 26/6 |
| Ind. Combustion | 5/- | 27/- | | 15 | 20 | 3 14 0 | 30/- | 14/6 |
| Johnson & Phillips | £1 | 47/- | +6d | 15 | 15 | 6 7 9 | 52/6 | 47/- |
| Lancashire Dynamo | £1 | 56/3 | | 12½ | 14 | 4 19 6 | 59/6 | 43/- |
| Laurence, Scott | 5/- | 29/- | +1/- | 15 | 20 | 3 9 0 | 29/- | 14/- |
| Lister, R. A. | £1 | 32/6 | | 9 | 12 | — | 33/- | 22/6 |
| London Elec. Wire | £1 | 51/6 | −2/- | 15 | 10* | 3 17 9 | 54/- | 38/- |
| Lucas, J. | £1 | 45/- | −6d | 10·8 | 7½* | 3 6 8 | 49/- | 25/3 |
| Marryat & Scott | 2/- | 9/6 | | 22½ | 25 | 5 5 3 | 8/3 | 5/11 |
| Mather & Platt | £1 | 47/6 | −2/- | 12½ | 15 | — | 53/- | 32/- |
| Metal Industries | £1 | 33/9 | | 12 | 9 | 5 6 6 | 42/3 | 29/6 |
| Midland Elec. Mfg. | £1 | 85/- | | 15 | 15 | 3 10 9 | 85/- | 63/- |
| Morphy-Richards | 4/- | 26/6 | | 40 | 35* | 5 5 9 | 26/6 | 11/4 |
| Murex | £1 | 50/6 | −6d | 15 | 15 | 5 19 0 | 57/- | 49/- |
| Newman Ind. | 2/- | 2/4½ | | 10 | 10 | 8 8 5 | 2/6 | 2/- |
| Oldham & Son | 1/- | 3/3xd | | 17½ | 17½ | 5 7 9 | 3/4 | 2/5 |
| Parnall (Yate) | 5/- | 10/9 | +1½d | 6 | 8 | 3 14 6 | 11/- | 4/3 |
| Parsons, C. A. | £1 | 60/- | +3/9 | 12½* | 7½* | 2 10 0* | 60/- | 38/1 |
| Plessey | 10/- | 60/-xd | | 30 | 20* | 3 6 8 | 62/- | 37/10 |
| Pye Deferred | 5/- | 33/6 | −1/6 | 20 | 20* | 2 19 9 | 37/- | 15/7 |
| Revo | 10/- | 15/-xd | +9d | 27½ | 9* | 6 0 0 | 20/3 | 14/- |
| Reyrolle | £1 | 87/6 | | 12½ | 13¾ | 3 2 10 | 92/6 | 66/- |
| Rheostatic | 4/- | 15/3 | | 19 | 20 | 5 5 0 | 15/9 | 11/- |
| Richardsons Westgarth | 5/- | 11/- | −3d | 15 | 15* | 6 16 4 | 12/3 | 6/6 |
| Scottish Cables | 4/- | 19/- | −6d | 20 | 27½ | 5 15 9 | 21/9 | 12/1 |
| Siemens Ord. | £1 | 42/6 | +3/6 | 10 | 10 | 4 14 3 | 44/- | 33/9 |
| Smith (England), S. | 4/- | 16/- | | 15 | 17½* | 4 7 6 | 16/- | 7/8 |
| Southern Areas | £1 | 32/6 | | 6 | 7½ | 4 12 4 | 32/6 | 17/6 |
| Strand Elec. | 5/- | 9/3 | −6d | 17½ | 17½ | 9 9 3 | 19/9 | 8/3 |
| Sturtevant | 5/- | 22/- | −9d | 18·1† | 18·9*† | — | 22/9 | 14/6 |
| Sun. Elec. | £1 | 31/3xd | | 15 | 15 | 9 12 0 | 33/9 | 27/6 |
| Switchgear & Cowans | 5/- | 12/- | | 22½ | 10 | 4 3 4 | 13/7 | 9/9 |
| Taylor Tunnicliff | 5/- | 11/3 | | 25 | 12½* | 5 11 0 | 12/4 | 10/7 |
| T.C.C. | 10/- | 40/- | | 20 | 30* | — | 40/- | 21/3 |
| T.C. & M. | £1 | 33/6 | | 10 | 8½* | 5 1 6 | 34/6 | 30/3 |
| Telephone Mfg. | 5/- | 9/6 | | 10 | 10 | 5 5 3 | 9/6 | 7/6 |
| Thorn Elec. | 5/- | 29/6 | −1/- | 12½ | 20 | 3 7 9 | 30/6 | 13/3 |
| Thornycroft | £1 | 37/-xc | −2/- | 25 | 15 | — | 39/6 | 26/6 |
| Tube Investments | £1 | 81/3 | | 15 | 17½ | 3 16 2 | 81/3 | 60/3 |
| Vactric | 5/- | 19/6 | +1/6 | Nil | 10 | 2 11 4 | 18/9 | 7/6 |
| Veritys | 5/- | 10/3 | | 10 | 12½ | 6 2 0 | 10/6 | 5/- |
| Walsall Conduits | 4/- | 52/6 | +6d | 70 | 70 | 5 6 8 | 52/6 | 44/- |
| Ward & Goldstone | 5/- | 42/6xd | | 45 | 50 | — | 43/6 | 21/- |
| Watford | 2/- | 6/6 | | 25 | 22½* | — | 7/3 | 4/7 |
| Westinghouse Brake | £1 | 86/3 | | 15 | 16 | 3 14 3 | 86/3 | 60/9 |
| West, Allen | 5/- | 17/9 | −3d | 15 | 17½ | 4 18 6 | 19/6 | 12/7 |
| Wolf Electric | 5/- | 17/6 | | 15 | 17½ | 5 0 0 | 17/6 | 11/- |
| *Trusts, Transport and Communications* | | | | | | | | |
| Anglo-Am Tel.: | | | | | | | | |
| A Ord. | 100 | 88 | | 6 | 6 | 6 16 4 | 89½ | 80 |
| Ord. | 100 | 54½ | | 3¾ | 3¾ | 6 17 6 | 55½ | 52 |
| Anglo-Portuguese | £1 | 24/9 | | — | 8 | 6 9 4 | 25/9 | 21/- |
| Brit. Elec. Traction: | | | | | | | | |
| Def. Ord. | 5/- | 22/- | | 35 | 50 | — | 24/- | 13/- |
| Cable & Wireless: | | | | | | | | |
| Ord. | £1 | 41/3 | | 8 | 9 | 4 7 3 | 49/6 | 26/2 |
| 4% Loan | 100 | 98½ | | 4 | 4½ | 4 1 3 | 98½ | 95½ |
| Calcutta Trams | £1 | 20/6 | | 2½† | 6† | 5 17 0† | 24/6 | 17/1 |
| Cape Elec. Trams | £1 | 16/- | | 5½ | 7 | 8 15 0 | 17/6 | 12/4 |
| Marconi Marine | £1 | 33/- | +6d | 10 | 10 | 6 1 3 | 35/- | 27/6 |
| Oriental Tel. Ord. | £1 | 97/6xd | | 16 | 16 | — | 99/1 | 82/6 |
| Telephone Props. | £1 | 90/- | −2/6 | — | — | — | 92/6 | 74/6 |
| Telephone Rentals | 5/- | 10/6 | | 10 | 10 | 4 15 3 | 10/6 | 9/- |

### Ada Interim

Ada (Halifax) 1s shares were dealt in around 2s 3d following the company's declaration of a 10 per cent interim dividend on account of the year ending next March. For the previous full year, a single payment of 15 per cent was made. The present price of the shares shows a moderate gain on last week, and compares with quotations of under 1s ruling earlier this year. In the last month or two the recovery will presumably have been assisted by the hire-purchase concessions, which reacted particularly favourably on the shares of companies connected with durable consumer goods such as washing machines. At the annual meeting held in the middle of this year, the chairman described energetic measures which were being taken to keep output in step with rising demands.

### Price Changes

British Electricity stocks show losses of half a point or so as a result of the setback in the gilt-edged market. The industrial share lists acquired a rather irregular appearance, but by the beginning of this week the majority of prices were up again to their previous marks. Shares with an electronic content were again favoured. Elliott Bros. 5s ordinary were the star turn, jumping 5s 6d to 38s in the course of a single day's business. In the market, Deccas rose vigorously to over 50s and Plesseys to 61s 6d xd. (The official quotations lagged behind these movements.) Laurence Scott went further ahead in anticipation of the scrip issue. Other good features were provided by Falk Stadelmann, Electric Construction and De la Rue. Losses occurred here and there, but few were of any serious proportions.

## Commercial Travellers' Benevolent Institution

The annual Court of Governors of the Commercial Travellers' Benevolent Institution will be held at the Berners Hotel, London, W.1, on 29th December, at noon, when all standing candidates will be recommended by the board for election without ballot.

# REPORTS and DIVIDENDS

**Brook Motors, Ltd.**—The report and accounts now issued show a trading profit of £595,594 for the year to 30th September last, as compared with £514,359 for the preceding year, to which is added other income making a total of £599,772 (against £518,652). After meeting all charges, including £245,330 for taxation, there is a net balance of £227,738 (against £107,495). A further sum of £95,000 is set aside towards future taxation and it is proposed to pay a final dividend of 15 per cent on 1,141,364 ordinary shares, making with the interim dividend of 5 per cent paid on 998,683 shares, a total payment for the year of 20 per cent (same on smaller capital). The balance carried forward is £498,858 (against £435,374 brought in).

In his circulated statement Mr. F. V. Brook (chairman) says that whilst turnover for the year under review is not a record, he is convinced that with the present rate of demand, only a short time will elapse before a new high level is reached. The 1½ million milestone of industrial motor production has been passed, and the problem is to find sufficient manufacturing space to meet the demand. Two further premises have been acquired.

The American subsidiary (Brook Motor Corporation) has now been established for twelve months and large stocks of motors are available in various parts of the United States. Next year will be a testing time for this new company to break into the American motor field. Mr. Brook refers to the company's jubilee celebrated during the year, the official opening of the new Barugh Green factory, now in full production, and the inauguration of a non-contributory works gratuity scheme for employees. With regard to the future, he says that additional accommodation will shortly be required to meet the increased fractional h.p. motor demand.

**Enfield Cables, Ltd.**—As we report elsewhere in this issue, Sir John Black has joined the company as deputy chairman. In making the announcement the directors state that as foreshadowed in the chairman's statement sent out with the 1953 accounts, the trading results for the year ending 31st December next will not be satisfactory. A substantial loss was incurred during the first half of the year. During the second half of the year the various measures initiated by the board and the reconstituted management began to show results and for that half of the year there is expected to be little, if any, loss. The board has confidence in the company's future and the better results now being achieved should be maintained and improved in 1955. The board expects to be able to recommend payment of dividends for 1954 at the full rate on both classes of preference shares but in the light of the foregoing it is unlikely that it will recommend the payment of any dividend on the ordinary capital.

**Pye, Ltd.**—The directors announce that plans are in hand for raising approximately £1,500,000 by an issue of 1,000,000 5½ per cent £1 second preference shares to holders of all the existing classes of stock and by a rights issue of "A" deferred ordinary shares to deferred ordinary and "A" deferred ordinary stockholders. The directors, in referring to the need for extending the group's activities, state that Pye Ltd., has recently bought the capital of a company supplying electrical control gear for industrial purposes and 60 per cent of the capital of a company supplying an essential and widely used component for the electrical and telecommunications industries. The board also states that owing to the unsatisfactory state of supply of certain essential parts for the radio and television business, the demand for the company's products has been unsatisfied. It is therefore proposed to raise further capital to buy and equip a cabinet factory which will be in operation within three months; finance the purchase of the capital of a cabinet-making company; and the capital of a component-making company. The undertakings already purchased and those now mentioned are expected to contribute not less than £250,000 to the group's profits in the first complete year of operation. The two issues will provide a balance of about £120,000 for working capital. The new preference shares will rank after the existing 5 per cent issue.

The proposals to create the new capital will be submitted to an extraordinary general meeting and separate class meetings of each stock on 17th December.

**Turner & Newall, Ltd.,** report a group profit for the year to 30th September last of £12,044,351, as compared with £11,987,945 for 1952–53. After providing £6,743,671 for taxation, there is a net balance of £5,300,680 (against £4,492,265), to which is added £272,723 unrequired tax provisions. From this are deducted allocations to reserves and other provisions, and the amount available for the parent company is £3,069,539 (£3,319,284). It is proposed to pay a final ordinary dividend of 17½ per cent (against 15 per cent), making 22½ per cent for the year (17½ per cent).

**The English Electric Co., Ltd.,** announces that a drawing of the 4½ per cent debenture stock 1972–77 for redemption will take place at the company's office, Stafford, on 14th December; £136,100 (nominal) of such stock will be drawn in units of £100 for redemption on 31st January next. A drawing of 4 per cent debenture stock 1965–85 for redemption took place on 7th December; £18,300 was drawn in units of £100 for redemption on 31st January.

**The Ever Ready Trust Co., Ltd.,** has placed privately £300,000 4¼ per cent debenture stock 1974–79 at 99 per cent.

**The Hackbridge & Hewittic Electric Co., Ltd.,** has declared an interim dividend of 7½ per cent (against 5 per cent). The increase is to reduce the disparity between the interim and final dividends.

**Hick, Hargreaves & Co., Ltd.,** are paying an interim dividend of 5 per cent (same) on capital enlarged by a one-for-two scrip issue.

**Scottish Cables, Ltd.,** announces an interim dividend of 7½ per cent (unchanged).

**The Oriental Telephone & Electric Co., Ltd.,** has declared an interim dividend of 4 per cent on the ordinary stock (unchanged).

## Increases of Capital

**Electrical Products (Colne), Ltd.**—Increased by £4,000, in £1 shares, beyond the registered capital of £1,000.

**Chas. R. Eames, Ltd.**—Increased by £26,000, in £1 ordinary shares, beyond the registered capital of £4,000.

**Atom Electrics (Northampton), Ltd.**—Increased by £5,000, in £1 ordinary shares, beyond the registered capital of £3,000.

## New Companies

**Palladin Lamps, Ltd.** — Registered 13th October. Capital £100. Manufacturers and dealers in electrical appliances and accessories, etc. Directors: Mrs. Mildred F. A. Spong and the Hon. Wm. F. B. Le Poer French, directors of Fiesta, Ltd. Regd. office: Alderman's House, Bishopsgate, E.C.2.

**Watt Bros. (Electrical), Ltd.**—Registered 11th November. Capital £100. Manufacturers and distributors of, agents for and dealers in electrical goods of all kinds, radio and television sets, etc. Directors: J. Hyams, R. M. Watt and S. Hall. Regd. office: 123, Pall Mall, S.W.1.

**Lawrence Perrins & Sons, Ltd.**—Registered 11th November. Capital £2,000. Manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, batteries, etc. Directors: L. Perrins and Mrs. May Perrins. Regd. office: 176, Oldham Road, Springhead, near Oldham.

**Space Heating, Ltd.**—Registered 28th October. Capital £100. Electrical and mechanical engineers, etc. Subscribers: S. Van Der Sluis and S. M. Hart. Regd. office: 121, London Wall, E.C.2.

**Keland, Ltd.**—Registered 28th October. Capital £1,000. Manufacturers and dealers in electrical goods, apparatus, appliances, etc. S. Anderson signs as director. Solicitors: T. D. Marshall Hall & Levy, South Shields.

**Malpas Electrical Services, Ltd.**—Registered 6th November. Capital £300. Directors: S. B. Rook and Gladys A. Rook. Regd. office: Old Market House, Church Street, Malpas, Cheshire.

**Phillips Brothers (Electrical Engineers), Ltd**—Registered 12th November. Capital £5,000. Directors: P. E. Phillips, J. E. Phillips and F. J. Phillips. Regd. office: 154, Wheeler Street, Lozells, Birmingham, 19.

## Bankruptcies

**D. G. H. Hammerton** and **A. J. Cummings,** trading as A.C.D. Electric Co., 28, West Street, Warwick, electrical engineers.—Public examination, 28th January at the Shire Hall, Warwick.

**J. G. Milne,** 34, Whitworth Road, Grangetown, Yorks., radio and electrical dealer.—Trustee, Mr. C. G. Sparrow, 62–63, High Street, Stockton-on-Tees, Co. Durham, released 21st October.

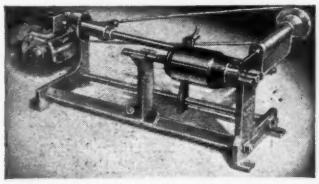
**J. Cooper,** residing at 15, Rectory Lane, Orford, and lately carrying on business at Market Place, Orford, mechanical and electrical engineer.—Supplemental dividend of 3s 9d in the £, payable at the Official Receiver's Office, 3 and 5, Northgate Street, Ipswich.

**F. R. A. Lock** and **V. C. Lock,** carrying on business at Union Street, Stourbridge, Worcs., under the style of Locke Brothers, electrical engineers. (Separate estate of V. C. Lock).—Application for discharge to be heard on 13th January at the Court House, Hagley Street, Stourbridge.

**C. R. Boydon,** carrying on business at Ivy House, Thorpe Mandeville, near Banbury, Oxon, lately carrying on business at 19a, Castle Street West, Banbury, electrical engineer.—Trustee, Mr. W. J. W. Hill, 58–61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 22nd November.

# MARTINDALE
# MICA UNDERCUTTERS

## AERO-AUTO



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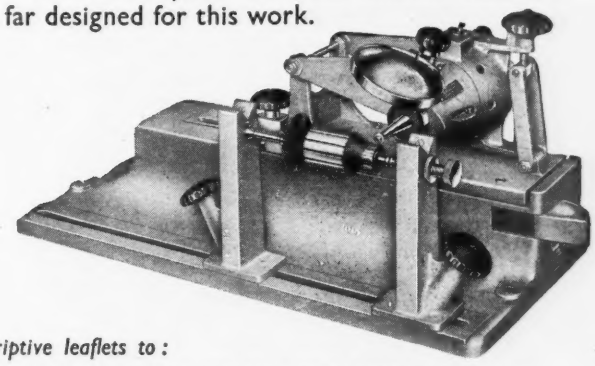

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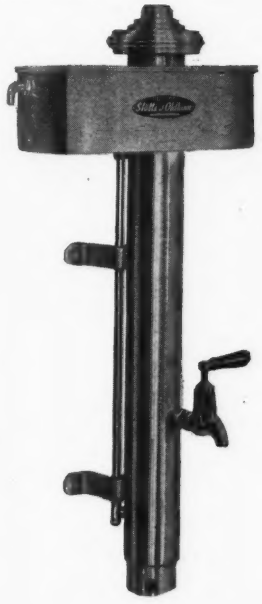
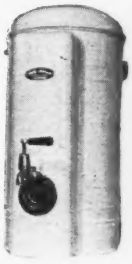
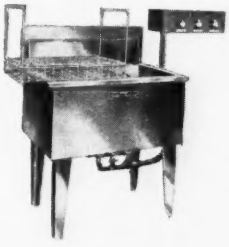


Cafe Wall Boiler—with an output of 64 pints per hour. Loading 4 kWs.



**Newport Water Boiler.**
Large reserves and high outputs are the characteristics of this new "Stott" Electrically-heated Water Boiler which make it ideal for Industrial Canteens and large-scale Caterers.



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After stripping and washing, crockery is immersed in the Sterilizing Sink and then allowed to dry out by its own heat.

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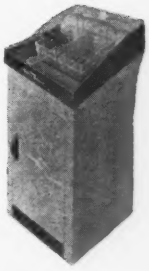
**Electric Deep Fryer.**
With quick reacting thermostat and high-efficiency elements, giving output of 27 lbs. of chips per hour. Swing-out elements for easy cleaning, and cool zone for sediment separation.



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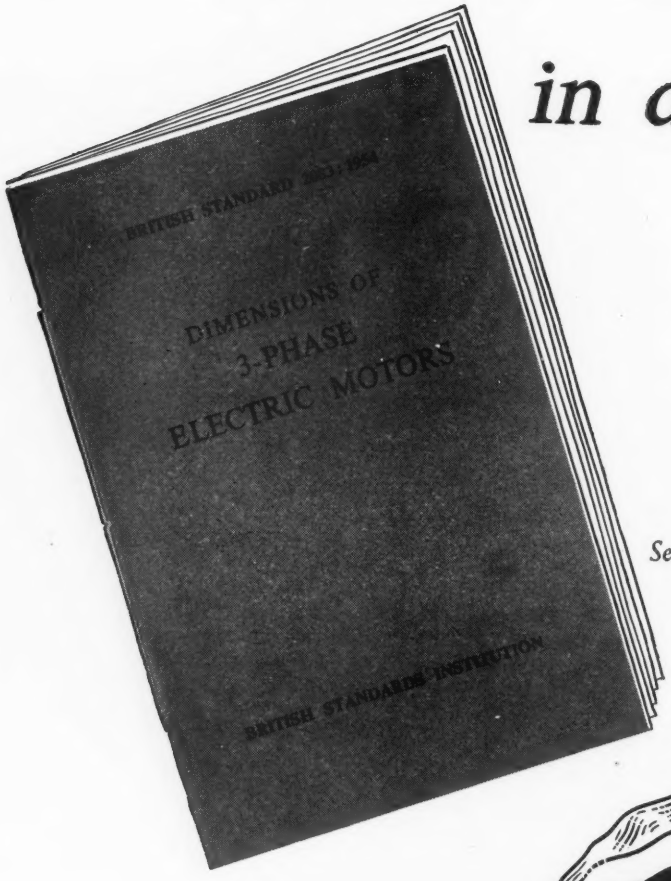
# Standardised dimensions *in a nutshell!*

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# GENERATION AND DEVELOPMENT

### *Fly Ash Utilization*

The increasing use of pulverized coal in power stations is making available large quantities of pulverized fuel ash, the output having risen from about 750,000 tons in 1947 to over 2,000,000 tons a year to-day, and it is expected to be 4,000,000 tons by 1960. The problem of usefully disposing of this ash in making building materials has been the subject of research for some time and at an exhibition arranged by the British Electricity Authority in London, which is now in progress, some of the many ways in which fly ash can be used are being shown. The building materials displayed include concrete cable covers, paving flags, building blocks, bricks, tiles, etc., some of the materials containing as much as 85 per cent of fly ash.

### *Yorkshire Tariff Questions*

At its recent meeting the Yorkshire Electricity Consultative Council was informed by the Board that no variation had been made in the tariff for places of worship, but on detailed consideration of the facts of individual cases it had been found possible to advise the churches on the most economic arrangements for taking full advantage of the available options, with the result that the majority of complaints had been satisfactorily settled.

In response to an inquiry from the Council with regard to the use being made of money boxes by consumers, the Board stated that the number of boxes in circulation on 1st July was 16,017 and that during the quarter ended 30th September, 10,693 of these were handed in for emptying.

### *Transporting Large Transformers*

On 21st November, a transformer weighing 82 tons was conveyed by special train from Redhouse power station, near Thornton (Fife), to Yoker power station (Clydebank). The load had a maximum height of 13ft 4½in from rail level and it was necessary to traverse it several times *en route* to clear tunnels and bridges. For the final shunting movement from Yoker yard to the power station a 9-in traverse was necessary to clear lineside structures. The vehicle used was a special transformer wagon with a capacity of 135 tons and fitted with traversing apparatus which enabled the load to be moved a maximum of one foot on either side of centre.

The second of four 72 MVA generator-transformers recently left the Witton Works of the General Electric Co., Ltd., on its way to the Ince power station of the British Electricity Authority, which is under construction on a site near Ellesmere Port, Cheshire. Robert Wynn & Sons ,Ltd., of Newport, Mon., were responsible for transporting the unit by road, using a 24-wheeled pneumatic-tyred trailer of 200 tons capacity for the purpose. Together with the trailer itself, the transformer, which was fitted with an on-load tapping switch, constituted a gross load of 148 tons. An unusual feature in the design of the transformer is the use of a nitrogen seal so that the oil in the unit is not in contact with the atmosphere. The Ince station will house four 60 MW hydrogen-cooled turbo-alternators, also to be supplied by the G.E.C. The first two sets have already been delivered.

### *Mobile Radio in the Highlands*

To expedite repair and maintenance work on the new 132 kV transmission line between Fort Augustus and Speyside, Marconi v.h.f. radio equipment is being used by the North of Scotland Hydro-Electric Board (*Electrical Review*, 3rd December, p. 898). Each of two small buildings erected near the top of the Corrieyairack Pass is equipped with a 5 W transmitter/receiver, type HP.110, for communication with the repair gangs, who will carry "walkie-talkie" sets. When an overhead line breakdown occurs on the Pass, two repair vans, each equipped with a 10 W transmitter/receiver, will transport repair gangs as far as possible up the Pass, whence they will climb to their advanced bases, the huts at the top. From there repair operations will be carried out, the repair gangs being in constant two-way communication with the huts or the vans below.

### *Record Number of New Consumers*

The Eastern Electricity Board announces that during October 6,276 new consumers were connected, more than in any one month since the Board's inception. This figure includes 147 farms. The previous highest number of new consumers connected was 6,162 in November, 1953.

### *Progress in North Scotland*

The 20,000th electricity consumer to be supplied with electricity in the North of Scotland Hydro-Electric Board's Northern Area was connected to the distribution system on 24th November by Sir Hugh Mackenzie, deputy chairman. This means that 83 per cent of the possible connections in the Board's Northern Area have now been completed, and the Board is progressing steadily.

### *Dudley System Modernization*

Work has been started by the Midlands Electricity Board on schemes costing £330,000 for modernizing and extending the distribution system at Dudley. A new grid substation is to be built at Springsmere and the supply to 1,000 consumers is to be converted from d.c. to a.c.

## OVERSEAS

### *Snowy River Power*

First power from the 60,000 kW Guthega section of the Snowy Mountains hydro-electric scheme should be available in three to four months. The Minister for National Development, Senator W. H. Spooner, making this announcement, said that construction of 19 miles of underground pipeline aqueducts on the sides of the Upper Snowy Valley was being resumed. These aqueducts would collect water for the Guthega dam which would normally run into the Snowy below the dam. The Norwegian Selmar Engineering Co. had worked on the dam, tunnel, pipeline and power station throughout the winter. Erection of the turbines and generators had reached an advanced stage. Senator Spooner said that it was possible

*Marconi "walkie-talkie" set in use on the Corrieyairack Pass*

to begin major development work on the scheme ahead of schedule because of the early thaw on the South Alps. The Kaiser-Walsh-Perini-Raymond group of the United States had begun preliminary work for its contract to drive 13·8 miles of tunnel from the Eucumbene River in the Snowy catchment to the western side of the Great Dividing Range. The group's contract also included construction of a 290ft concrete dam on the Upper Tumut River, and it expected to build up a labour force of about 1,200 men by the end of the year. This force would increase to 2,000 later. An advance party of a French group of contractors had arrived to begin work on the first Tumut River power station. This station (1,100ft below ground in the side of the Tumut River gorge near Cabramurra) would have a capacity of 328,000 kW. He said that as the contractors were taking over the major construction operations the Snowy Mountains Authority's own employees were moving back into the mountains where they were providing access roads and collecting data for the construction of future projects.

### *Peat Power Station*

The Irish Electricity Supply Board is seeking tenders for the civil construction works for a new power station to be erected at Lanesborough, Co. Longford, on a ten-acre site on the left bank of the River Shannon.

The plant will comprise a 20,000 kW turbo-generator and a 220,000 lb/hr boiler. Some 100,000 tons of machine-won sod peat from the adjacent Derryaroge and Mount Dillon bogs will be used.

### *Rapid Expansion in Trinidad*

Since the Trinidad and Tobago Electricity Commission was formed in 1946 the annual output of electricity has increased from 33·7 million to 82·9 million kWh and load estimates indicate that future development is likely to be even more rapid. The Commission's report for 1953 records a rise in sales during the year of 29 per cent to a total of 71·3 million kWh and new consumers connected numbered 3,965, although expectations were that it would only be possible to add about 2,000 annually. Revenue in 1953 totalled $2·9 million and there was a net surplus of $2,590. The average price received per kWh sold decreased from 5·19 to 4·92 cents.

### *Rising Output in W. Australia*

In his report for the year ended 30th June last, Mr. F. C. Edmondson, general manager and chief engineer of the State Electricity Commission of Western Australia, describes the period as one in which good progress was made in a number of

directions, e.g., in the frequency standardization scheme for the metropolitan area (the supply to 21,637 consumers was changed over, making 60,084 so far dealt with); in the south-western rural areas 888 miles of overhead line was erected; and the first plant in the South Fremantle "B" station was commissioned. A total of 349 million kWh was generated (against 306 million in 1952–53), sales amounting to 304·8 million kWh (266·6 million).

In a foreword to the report Mr. Alex J. Reid, who during the year succeeded Mr. R. J. Dumas as chairman of the Commission, says that in its plans the Commission has made full provision for the greatly accelerated industrial development and increase in population of the State. In 1949 the Commission gave an undertaking that it would stand on its own feet and fund any future deficits until balance was reached, and this had been practically achieved. A surplus of £120,791 had been attained in 1953–54 (after taking into account a Treasury contribution of £72,000 towards the loss of £80,413 on the south-west power scheme) and the accumulated deficit of £215,303 had thereby been reduced to £94,512.

### *Electricity Costs in Ceylon*

Mr. Montague Jayawickreme, Minister for Transport and Works of Ceylon, recently announced that two United Kingdom accountants would shortly arrive in the island to undertake a review of electricity tariffs with the object of reducing charges to working class consumers. The Minister also stated that in future all electrical connections, particularly within the Colombo Municipality, would be carried out free of charge, or on easier terms. He said it would not be possible for the Government to agree to the request of the Mayor of Colombo for the municipalization of the city's electricity supply, but electricity to run the trolley-buses would be provided to the Municipal Council at cheaper rates than at present.

### *Bombay Electricity Board*

The Government of Bombay has constituted a three-member Electricity Board for the State under the chairmanship of Mr. M. H. Hasham Premji. The Board has been charged with the general duty of promoting the co-ordinated development of the generation, supply and distribution of electricity within the State.

### *Water Power in Mysore*

The State of Mysore, India, has developed only 6·8 per cent of its potential hydro-electric power and detailed surveys are being made to assess the most economical and feasible project out of the several schemes the Government has in view. The Honnemaradu development, the biggest yet worked out, is now awaiting sanction by the Government of India. This scheme is expected to make available 540,000 kW, excluding the present 120,000 kW capacity at Jog.

Among the other projects which the Mysore Government has in view are the Shimsha new station, the Mekadatu project, hydro-power development from Tungabhadra Valley at the Lakkavalli dam site, the Tungabhadra dam site station and power canal station, the Manakundar project and the Varahi hydro-electric project.

### *Uttar Pradesh Plant Extensions*

An additional 70,000 kW of generating plant is expected to be available during the next two years in Uttar Pradesh, India, from the several power schemes in course of construction. A plan for the electrification of a large number of small towns has been approved.

### *Colombian Project*

As a first step towards the industrialization of the Cauca Valley, West Colombia, the Government of Colombia has allocated 500,000 pesos to finance preliminary survey work. The plan envisages the construction of reservoirs and dams for flood control and irrigation and as sources of hydro-electric power and the erection of power plants for industrial purposes.

### *Rotterdam Station Completed*

The last unit of the new Rotterdam power station was put into operation recently, thus completing the country's largest power station. Its capacity is 300 MW, equal to 12 per cent of the total capacity of the Netherlands' public electric power stations.

### *Development in Victoria*

An Electrical Industries Fair, one of the most comprehensive electrical exhibitions ever held in Australia, was staged recently for two weeks at Melbourne. The exhibition covered all aspects of power production and every conceivable electrical device was on show. The expansion of electricity generation and distribution was illustrated by the State Electricity Commission's display. Within seven years Victoria is expected to be virtually "all-electric." By that time every home, except a few dwellings in remote mountain areas, will be connected to the public supply. This is the target set by the S.E.C. in its 10-year plan. Rural electrification is already two-thirds complete, and the plan is ahead of schedule. Three-quarters of Victoria's electricity is generated in steam power stations from Yallourn brown coal, either raw or in briquette form. New plant using raw coal at Yallourn and Morwell will add more than 500,000 kW within the next few years. A new 62,000 kW hydro-electric set at Kiewa is due for completion next year and work is being resumed on the Rocky Valley Dam, which is vitally important to the Kiewa scheme. Two 60,000 kW generators at a new power station below Big Eildon Dam should be in service by the end of 1956. New S.E.C. construction is at present costing £25–30 million a year.

*The Minister of Transport, Mr. John Boyd-Carpenter, accompanied by Lord Brabazon of Tara, enters the last surviving 1898 Krieger battery-electric brougham to drive to a recent Roadfarers' Club luncheon at the Savoy Hotel, London. The car is owned by Mr. Edward Powell (left), a director of Chloride Batteries*

## *LIGHTING NOTES*

POPLAR Works and Markets Committee reports that consultations have taken place with the Traffic Branch of the Metropolitan Police as to the most suitable type of lighting at important junctions in foggy weather. At present, lighting is by portable acetylene flares but it has been suggested that permanent lanterns with sodium lamps would be better. In the first instance, lanterns are to be installed in East India Dock Road by the entrance to Blackwall tunnel and in Bow Road by Bow Bridge.

The Ministry of Transport and Civil Aviation has approved the NORTHAMPTON Council's application for consent to borrow £19,916 for the fourth stage of the conversion of street lighting from gas to electricity.

FELLING (Co. Durham) U.D.C. is seeking loan sanction for £2,300 for converting the gas lighting in Watermill Lane and High Lane to sodium discharge lighting.

ENNERDALE (Cumberland) R.D.C. is considering a proposal that the Council should spend £5,000 to complete, in one operation, the conversion of the street lighting from gas to electricity. Normally the change-over would occupy another five years.

A start is to be made within the present financial year on a £7,000 scheme to convert the street lighting system along the Birmingham to Lichfield trunk road (A38) in SUTTON COLDFIELD. The first section to be dealt with will be from the city boundary through Wylde Green to the centre of the town.

During the next two years the whole of the remaining gas street lighting in GRANTHAM is to be converted to electricity. The cost will be about £16,000 and 668 lamps are to be provided.

Gas street lighting at MARKET DEEPING is to be converted to electricity by the South Kesteven (Lincs.) R.D.C.

The Ministry of Transport has approved a £2,500 gas to electricity conversion scheme for the central areas of HORBURY.

## Profit from Trolley-buses

During the year ended 31st March last South Shields Corporation trolley-buses made a profit of £14,601 while there was a deficit of £10,313 on the motor-buses. The net surplus on the joint undertaking amounted to £4,288 or £4,259 more than in the previous year.

# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 12th January from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

**1948**

18074. Postmaster General.—Method of checking the creeping of cores within the sheaths of electric cables. 29th November, 1950. (721662.) 18075.—Method of joining electric cables. 29th November, 1950. (721663.) 18637.—Adjustable moulding device for moulding a roll of plastic material about a longitudinal core. 29th November, 1950. (721664.) 21148.—Method of sealing sheathed electric cables. 29th November, 1950. (721665.)

**1949**

4050. Broadhurst, S. W., and Hayward, R. K.—Automatic telephone exchange equipment. 14th February, 1949. (721822.)

**1950**

12568. Electric & Musical Industries, Ltd.—Magnetizable core circuits such as are utilized in computing apparatus. 21st May, 1951. (721669.)

15514. Telefonaktiebolaget L. M. Ericsson.—Electron-tube device. 21st June, 1950. (721583.)

22528. British Thomson-Houston Co., Ltd., and Carter, H. F.—Electric motor control systems. 27th August, 1951. (721584.)

24718. Key, J. H.—Electric discharge tubes. 10th October, 1951. (721585.)

29223. Western Electric Co., Inc.—Signal translating devices utilizing semi-conductive bodies and methods of making them. 29th November, 1950. (721671.)

**1951**

779. United Electrical Co. (Coolex), Ltd.—Electrical switchgear of the enclosed metal-clad type. 11th January, 1952. (721588.)

5461. Bendix Aviation Corporation. Clamping means for cables particularly electric cables in plug and socket connectors. 6th March, 1951. (721872.)

12925. Watford Electric & Manufacturing Co., Ltd., and Gascoine, A. C.—Electrical contactors. 30th May, 1952. (721747.)

13648. General Electric Co., Ltd., and McKeag, A. H.—Luminescent materials. 28th May, 1952. (721596.)

15299. Shardlow Electric Wires, Ltd., and Jones, P.—Electrical coaxial cable coupling means. 18th July, 1952. (721597.)

23233. Siemens Bros. & Co., Ltd.—Electromagnetically-operated step-by-step mechanisms. 26th September, 1952. (721753.)

24006. Automatic Electric Laboratories, Inc.—Cold cathode gaseous discharge devices having an auxiliary control electrode. 15th October, 1951. (721598.)

24733. Vogt, A.—Electric vacuum control devices. 23rd October, 1951. (721677.)

25098. Standard Telephones & Cables, Ltd.—Amplifying or controlling tube section for the voltages under comparison in voltage-comparing indicator tubes. 26th October, 1951. (721599.)

25632. British Electricity Authority, and Marshall, A. T.—Method of and apparatus for continuously testing the concentration of a constituent present in liquid. 2nd February, 1953. (721884.)

26458. General Electric Co., Ltd., and Nixon, R. D.—Cathode-ray tubes. 9th September, 1952. (721601.)

28734. Siemens Bros. & Co., Ltd.—Electric selective signalling systems. 4th December, 1952. (721683.)

**1952**

483. Egyesult Izzolampa es Villamossagi Reszvenytarsasag.—Cathodes and method of making them. 7th January, 1952. (721837.)

857. Parsons, Ltd., C. H., and Handley, G. B.—Interlocking mechanism between electric switches and removable elements associated therewith. 2nd December, 1952. (721888.)

1144. Parker, R. H.—Time switches. 5th January, 1953. (721890.)

1988. Igranic Electric Co., Ltd.—Electric motor control systems. 24th January, 1952. (721686.)

2541. Hoover, Ltd., and Hands, C. H.—Washing machines. 22nd January, 1953. (721892.)

2765. Philco Corporation.—Cathode-ray tube systems. 1st February, 1952. (721687.)

2807. National Research Development Corporation.—Phase sensitive rectifiers and the like. 23rd December, 1952. (721894.)

3021. General Electric Co., Ltd.—Circuit arrangement for operating an electric-discharge lamp. 2nd February, 1953. Addition to 602858. (721762.)

3309. National Research Development Corporation.—Beam deflection systems for cathode-ray tubes. 26th January, 1953. (721689.)

3458. Automatic Telephone & Electric Co., Ltd.—Telecommunication systems. 27th January, 1953. (721764.)

4189. Simplex Electric Co., Ltd.—Electric change-over switches. 12th February, 1953. (721690.)

4639. Marconi's Wireless Telegraph Co., Ltd.—Automatic protection circuit arrangements for thermionic valves. 10th October, 1952. (721766.)

6697. Ormond Engineering Co., Ltd., and Davis, S. P.—Hair dryers. 13th March, 1953. (721693.)

7777. Midgley, A. H.—Electric time switches. 16th February, 1953. (721606.)

8017. Sauter Akt.-Ges. Fabrik Elektrischer Apparate, F.—Contact selector driven by a small synchronous motor. 28th March, 1952. (721607.)

9083. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 9th April, 1953. (721698.)

9338. Cantie Switches, Ltd.—Casings, boxes and the like such as electrical fuseboard casings. 9th April, 1953. (721774.)

9728. Siemens & Halske Akt.-Ges.—Cathodes for electric-discharge tubes. 17th April, 1952. (721612.)

10697. Babcock & Wilcox, Ltd.—Vapour generating and superheating units and a method of regulating the temperature of superheat therein. 28th April, 1953. (721614.)

12606. British Thomson-Houston Co., Ltd.—Electric relays. 19th May, 1952. (721617.)

18599. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—A.c. generators. 17th July, 1953. (721709.)

18809. Lodge-Cottrell, Ltd.—Apparatus for the electrical precipitation of suspended particles from gaseous fluids. 1st July, 1953. (721846.)

18822. General Electric Co., Ltd., and Burwell, P. J.—Thermionic valve circuits. 6th October, 1953. (721626.)

19284. Shirley, F.—Methods of, and apparatus for, heat treating articles by high-frequency electrical energy. 30th July, 1952. (721710.)

19525. Western Electric Co., Inc.—Electrical coils. 1st August, 1952. (721711.)

22487. C.A.V., Ltd.—Electromagnetic vibratory electric circuit interrupters. 10th August, 1953. (721634.)

22857. General Electric Co.—Electronic control circuits. 11th September, 1952. (721851.)

25001. Ricardo & Co., Engineers (1927), Ltd.—Automatic emergency electric generating plants. 1st October, 1953. (721933.)

25256. Bristol Aeroplane Co., Ltd.—Electromagnetically-operated load release units. 18th September, 1953. (721789.)

25519. Avery, Ltd., W. & T. (Schenck Maschinenfabrik Ges., C.).—Photo-electrically controlled apparatus for producing a.c. in synchronism with rotation of a member. 11th October, 1952. (721856.)

26235. Electrical Instruments Company (Hillingdon), Ltd., and Parton, J. E.—Moving coil synchroscopes. 19th October, 1953. (721934.)

27307. British Thomson-Houston Co., Ltd.—Insulated wire coils for dynamo-electric machines. 14th January, 1953. (721649.)

27614. Philips Electrical Industries, Ltd.—Synchronizing circuits for electric oscillators. 3rd November, 1952. (721791.)

28741. Sundin, A. T., and Nilsson, H. N.—Automatic switching device for radio amplification and similar systems. 14th November, 1952. (721653.)

29445. Aktiebolaget Elektrolux.—Dish-washing machines. 21st November, 1952. (721730.)

30179. Scholes & Co., Ltd., G. H., Pearce, F. J., and Pearce, G. S.—Switch and fuse units for electrical installations. 22nd September, 1953. (721684.)

32254. Telefonaktiebolaget L. M. Ericsson.—Electrical impulse generator. 19th December, 1952. (721795.)

**1953**

163. General Electric Co.—Dynamo-electric machines. 2nd January, 1953. (721799.)

324. Hoover, Ltd.—Hand irons. 5th January, 1953. (721804.)

719. Standard Telephones & Cables, Ltd.—Frequency stabilization systems. 9th January, 1953. (721806.)

2457. British Thomson-Houston Co., Ltd.—High-speed electronic impulse counters. 28th January, 1953. (721814.)

2458. General Electric Co.—Brush holder assemblies for dynamo-electric machines. 28th January, 1953. (721815.)

2741. Standard Telephones & Cables, Ltd.—Electric pulse code communication systems. 30th January, 1953. (721818.)


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# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

### CONTRACTS OPEN

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.*

**Australia.**—27th January. State Electricity Commission of Western Australia, Perth. Three 66 kV circuit breakers and a potential transformer. (E.S.B. 27972/54. Ten/11645.)*

21st April. Southern Electricity Authority of Queensland, Brisbane. Two steam boilers and accessories, and automatic control instruments for Bulimba "B" power station. (E.S.B. 27737/54. Ten/11629.)*

**Belfast.**—30th December. Electricity Department. Analytic balance, titration bench and conductivity meter. (See this issue.)

**Costa Rica.**—10th January. Instituto Costarricense de Electricidad, San Jose. Diesel-electric generating plant of 10,000 to 15,000 kW. (E.S.B. 27999/54. Ten/11662.)*

**Dagenham.**—22nd January. Corporation. 110 new or secondhand reflectors. (See this issue.)

8th January. Electric lamps, cables, conduit and accessories for one year. Borough surveyor, Civic Centre.

**Edinburgh.**—North of Scotland Hydro-Electric Board. Outdoor 132 kV switchgear and ancillary equipment for Clunie substation. (See this issue.)

**Egypt.**—1st February. Cairo Electricity and Gas Administration. 63 kV underground cable system and associated switching stations. (E.S.B. 27158/54. Ten/11644.)*

**Exeter.**—17th January. City Council. Vertical spindle electric pump at the Countess Wear sewage works City surveyor, 7, Southernhay West.

**Grimsby.**—31st December. Education Committee. Electrical installations in connection with the erection of a special school for sub-normal pupils at Carnforth Crescent. J. V. Oldfield, borough engineer, Municipal Offices, Town Hall Square.

**Hertfordshire.**—County Council. Applications are invited for inclusion on the approved list of contractors for building and maintenance works, heating and electrical works, fencing works, etc. (See this issue.)

**India.**—23rd December. Department of Electricity, Government of Madras. H.v. insulators. (E.S.B. 28065/54. Ten/11665.)*

31st December. Stores Purchase Committee, Government of Mysore, Bangalore. Two 78 kV oil circuit breakers for Shimshapura power station. (E.S.B. 28058/54. Ten/11666.)*

14th February. Director General of Supplies and Disposals, New Delhi. Two 3,000 kW steam generating plants, and transformers and switchgear for Kandla Port scheme. (E.S.B. 27697/54. Ten/11592.)*

**Iraq.**—1st February. Directorate General of Legal Affairs and Contracts, Bagdad. Air conditioning plant, electrical boiler and lift equipment for the new Houses of Parliament. (E.S.B. 27675/54. Ten/11581.)*

**Irish Republic.**—12th January. Dublin Port and Docks Board. Three electric goods lifts. (E.S.B. 28163/54. Ten/11685.)*

**Manchester.**—31st December. Corporation Waterworks Committee. 2,000 yd of multicore cable at Haweswater works, Westmorland. (See this issue.)

**New Zealand.**—30th December. Comptroller of Stores, New Zealand Railways, Wellington. Twenty main line diesel-electric locomotives. Specifications from the High Commissioner for New Zealand, 415, Strand, London, W.C.2 (reference No. C/F 99/704).

19th January. Post and Telegraph Department, Wellington. Capacitors. (E.S.B. 27778/54. Ten/11628.)* 28th January. Twin-twisted cable. (E.S.B. 27777/54. Ten/11635.)*

**Pakistan.**—22nd December. Director General of Supply and Development, Karachi. Current transformers and isolator switches. (E.S.B. 27927/54. Ten/11642.)*

**Philippines.**—10th January. National Power Corporation, Manila. Power transformer, switchgear, accessories and spares for the San Fernando substation, Agno River No. 1 hydro-electric project. (E.S.B. 27981/54. Ten/11641.)*

**Richmond (Yorks).**—3rd January. R.D.C. Electrically operated ejector plant in duplicate, and pumping plant for Gilling sewerage; also electrically operated pumping plant in duplicate for Aldborough sewerage. A. Brooksbank, consulting engineer, 14, The Exchange, Bradford.

**Romford.**—Borough Council. Electric lamps for one year. Borough engineer.

**Somerset.**—Education Committee. Heavy duty electric cooking equipment, water heaters, potato peelers, mixers, etc. Chief education officer, County Education Office, Trull Road, Taunton.

**South Africa.**—30th December. Union Tender and Supplies Board. Radio valves for the South African Air Force. (E.S.B. 27853/54. Ten/11609.)* Radio valves for the South African Navy. (E.S.B. 28261/54. Ten/11694.)*

**Thailand.**—12th February. Lignite Thermal Power Organization, Bangkok. Two 5,000 kW generating plants for lignite burning. (E.S.B. 27976/54. Ten/11649.)* 69 kV switchyard. (E.S.B. 27975/54. Ten/11648.)*

**United States.**—4th January. Bureau of Reclamation, Denver, Colorado. One 10,000 kVA outdoor-type auto transformer and one 12,500 V outdoor-type grounding transformer. (E.S.B. 27345/54. Ten/11633.)*

**West Riding.**—10th January. County Council. Re-wiring of the electrical installation in the Harrogate Technical School and School of Art. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

### ORDERS PLACED

**Chadderton (Lancs).**—U.D.C. Installation of 60 Group "A" road lighting columns.—Cohen Bros. (Electrical), Ltd.

**Edmonton.**—Housing and Building Committee. Electrical installations in dwellings being erected on the Potters Bar estate (£3,343).—Holliday, Hall & Stinson.

**Glasgow.**—Education Committee. Electrical work at Drumchapel Primary School (£1,970).—Claud Hamilton.

### WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Amble.**—Houses (23), Links estate; U.D.C. surveyor.

**Blyth.**—Proposed Methodist Church, Twelfth Avenue; Bainbridge and Dann, solicitors for the Methodist Circuit, County Chambers, Westgate Road, Newcastle-on-Tyne.

**Boldon (Co. Durham).**—Houses and flats (94), West Boldon estate; U.D.C. surveyor.

**Brighton.**—Factory extensions on the Hollingbury Industrial estate (£40,023); McKellar and Westerman, Ltd., builders, 143, Church Road, Hove, 3.

**Bristol.**—Factory, Brislington estate; Schweppes, Ltd., Schweppes House, Cennaught Place, London, W.2.

**Bromsgrove.**—Houses (292), Callowbrook Farm, Rubery; A. & J. Mucklow, Ltd., Halesowen.

**Carlisle.**—Extensions to Albion Works, London Road, for J. Bendall & Sons, Ltd.; Johnston & Wright, architects, 13, Castle Street.

**Chester.**—Erection of Highfield Infants' School, Southway; Shones (Buckley), Ltd., Church Road, Buckley, Ches.

**Cornwall.**—New schools at Wadebridge and Carclaze, St. Austell, S. Gregson, county architect, County Buildings, Truro.

**Croydon.**—Office block, High Street; South Croydon Investments, Ltd., 531, Oxford Street, London, W.1.

**Doncaster.**—Technical high school for boys, Armthorpe Road; borough architect.

**Evesham.**—Houses (44), Fairfield; Permerton & Bateman, architects, 21, Vine Street.

**Falmouth.**—Houses (48) and other buildings, Boscawen estate; E. J. K. Gibbons, town clerk, Municipal Offices.

**Guildford.**—Civic hall (£160,000); borough surveyor, Municipal Offices, High Street.

**Hartlepool.**—Child welfare centre, Hartlepool; George Evans, builder, Bishopton Lane, Stockton-on-Tees.

**Haslingden.**—Factory, for Durie & Miller, Ltd.; Ashworth & Hobson, Ltd., Lee Brook, Burnley Road, Rawtenstall.

**Lowestoft.**—Dwellings (198), Beeches estate; borough surveyor, 49, High Street.

**Margate.**—Factory, Westwood Industrial Estate; Algraphy, Ltd., lithographic plate manufacturers, Willowbrooke Grove, Bermondsey, London, S.E.15.

**Norman Cross (Hunts).**—Houses (54), Yaxley, for R.D.C.; Derek Crouch, Ltd., Station Chambers, Peterborough.

**Northampton.**—Houses (150); R.D.C. architect.

**Preston.**—Secondary modern school in Longridge Road for Lancaster R.C. Diocesan Schools Commission; W. C. Mangan, architect, 2, Ribblesdale Place.

**Rochester.**—Dwellings (150), Temple estate; borough surveyor.

**Sunderland.**—Houses, Farringdon estate; L. W. Evans, Ltd., builders, Norfolk Street (102) and G. H. Plemper, Ltd., St. Hilda's Works (56).

Houses, High Southwick estate; R. G. Finlay, Ltd., Ryhope (44) and A. V. Clerey and Son, Frederick Street, Sunderland (43).

**Tottenham.**—Dwellings (136), Weir Hall estate; borough engineer.

**Wallasey.**—Erection of a new hostel at Moreton for B.C. (£25,115); J. L. Rawsthorne & Co., Belvedere Sawmills.

**Wallsend.**—County secondary school (£140,250) and R.C. school (£41,000); county architect, Newcastle-on-Tyne.

**Wellington (Salop).**—Old people's home, Vineyard estate (£30,000); C. H. Simmons, county architect, Column House, London Road, Shrewsbury.

**Wigan.**—Factory at Kitt Green, for H. J. Heinz Co.; Douglas Matthews & Partners, architects, Ebury Street, London, S.W.1.

**Wood Green.**—Municipal offices; Stinton Jones & Partners, electrical and heating consultants, 21, Gloucester Place, W.1.

**Workington.**—Dwellings (538), Moorclose Valley; borough surveyor.

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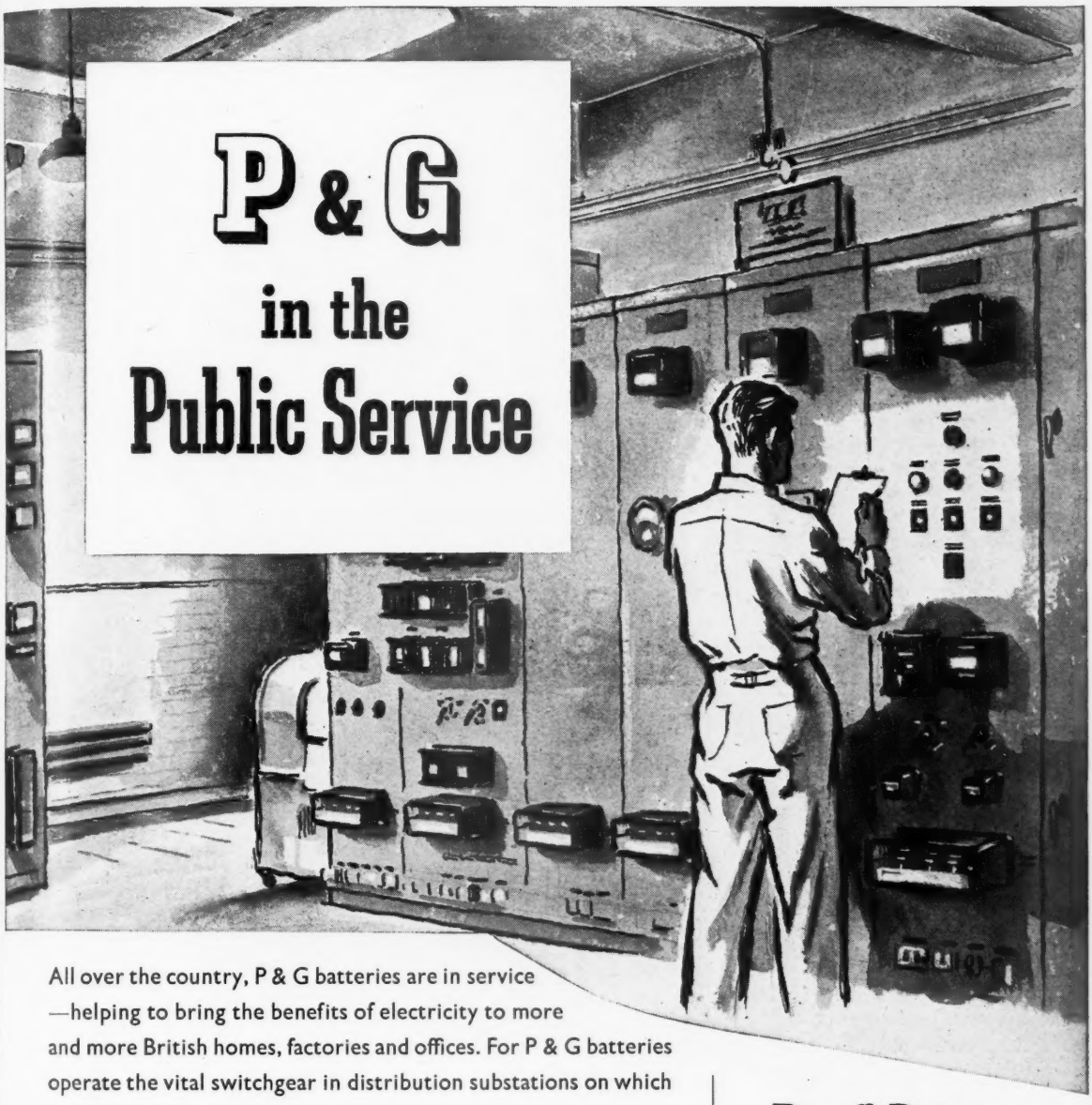

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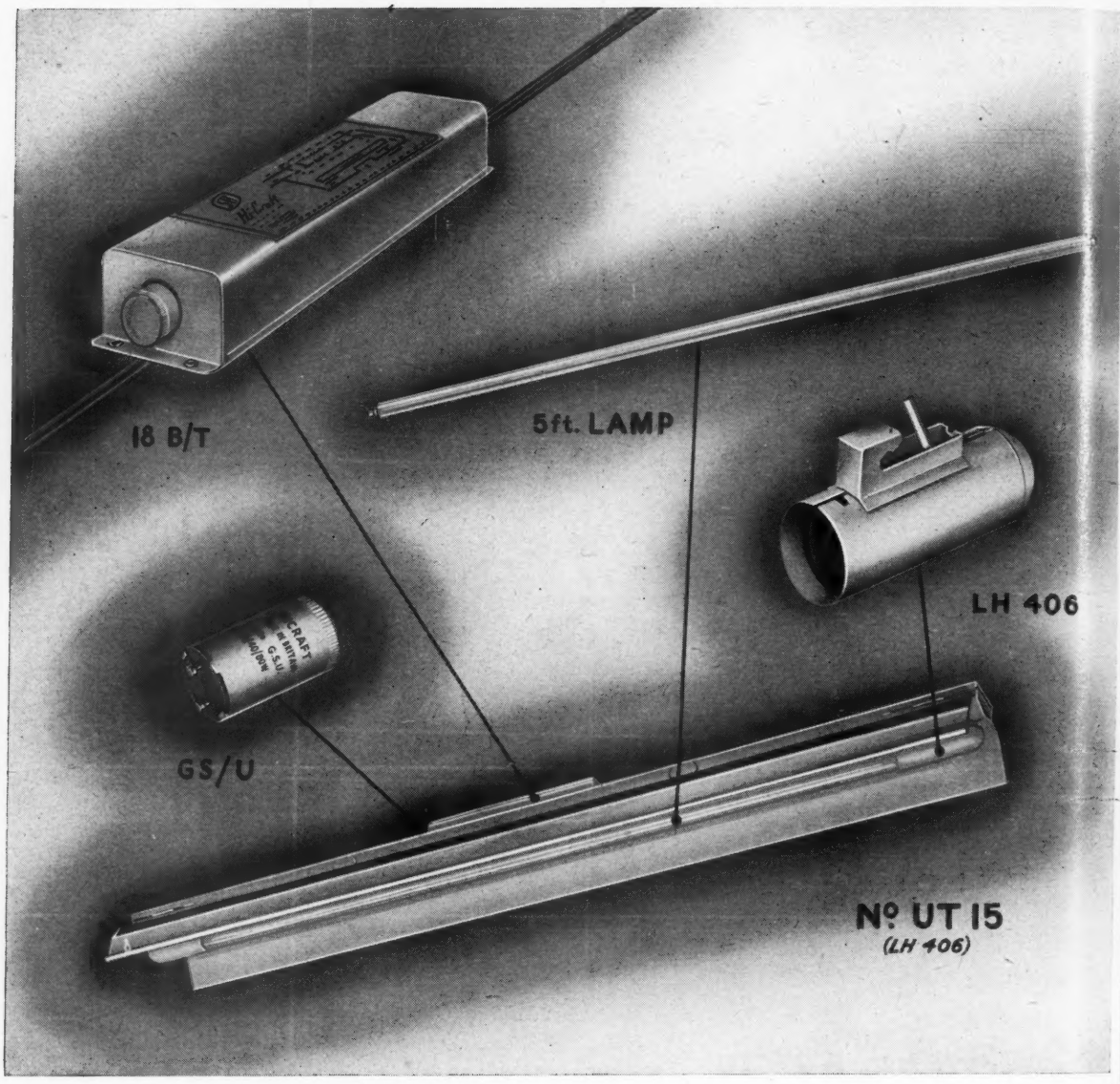


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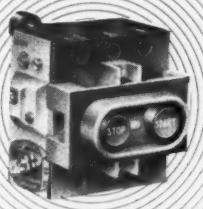

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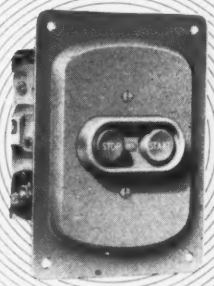

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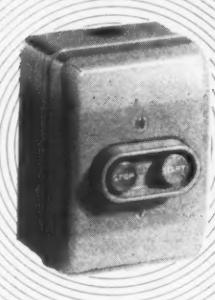

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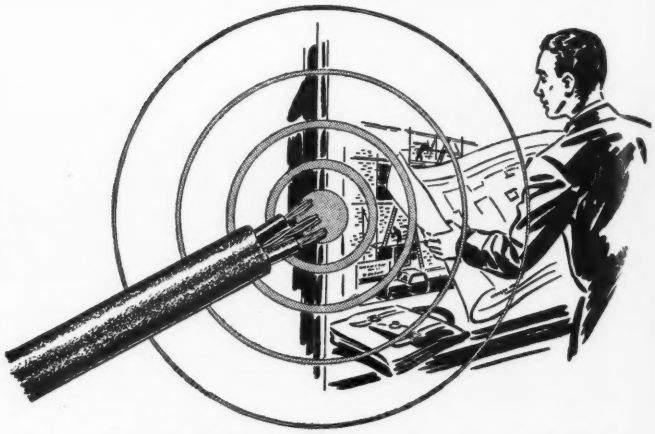

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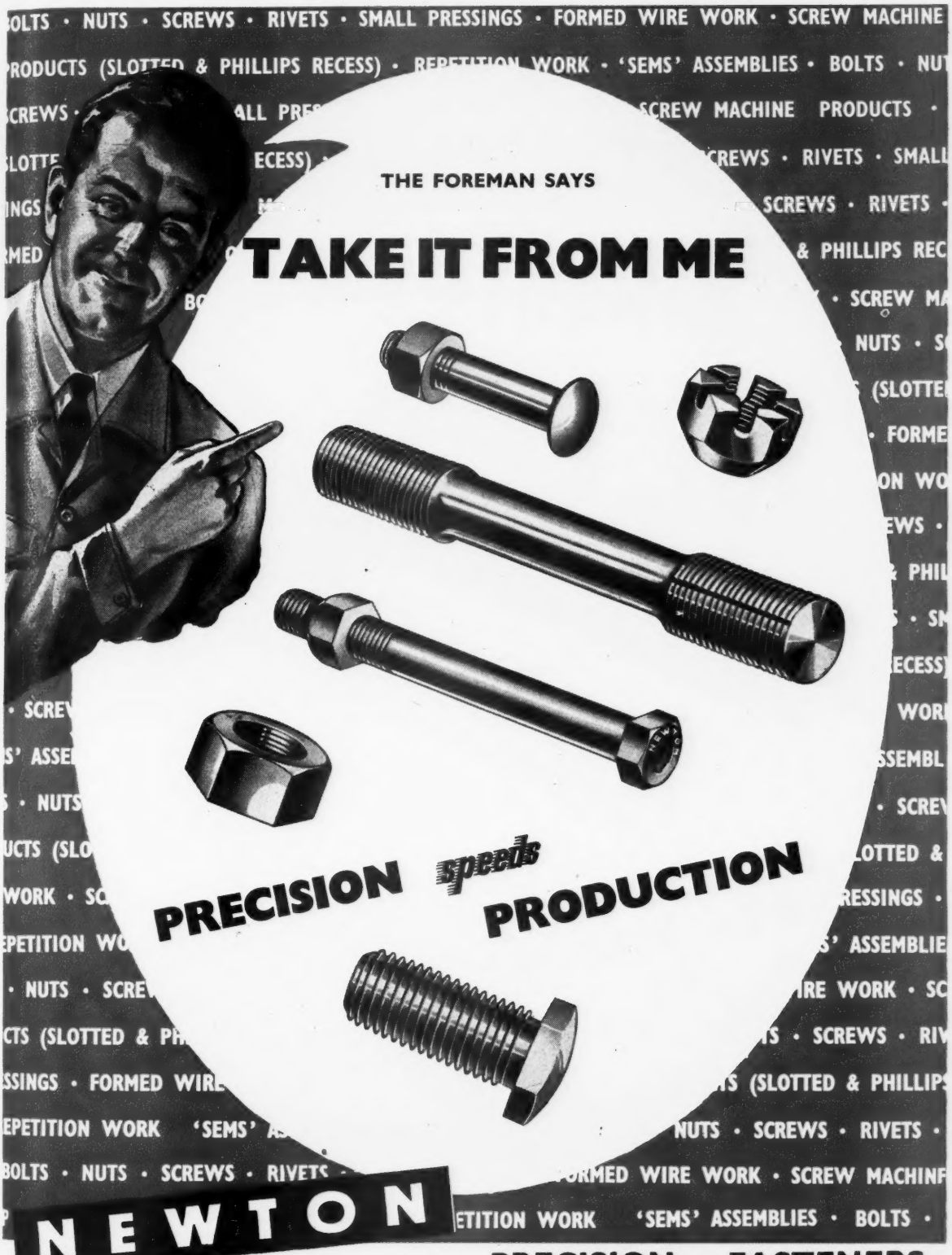


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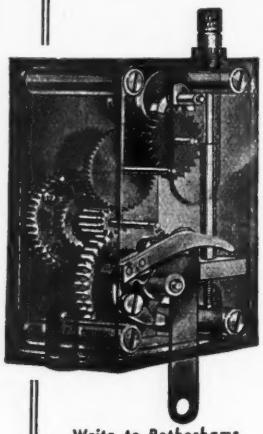

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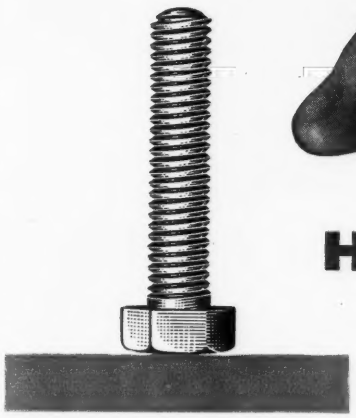

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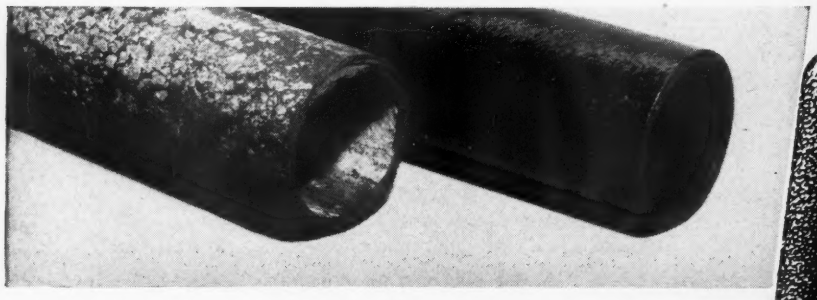

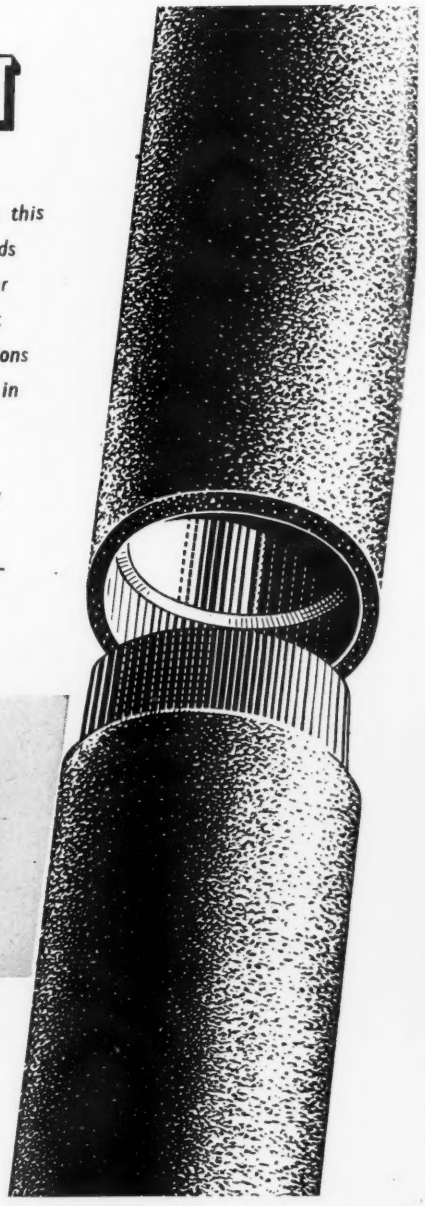

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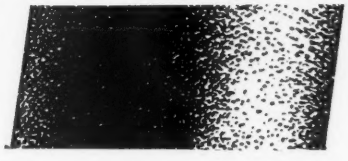

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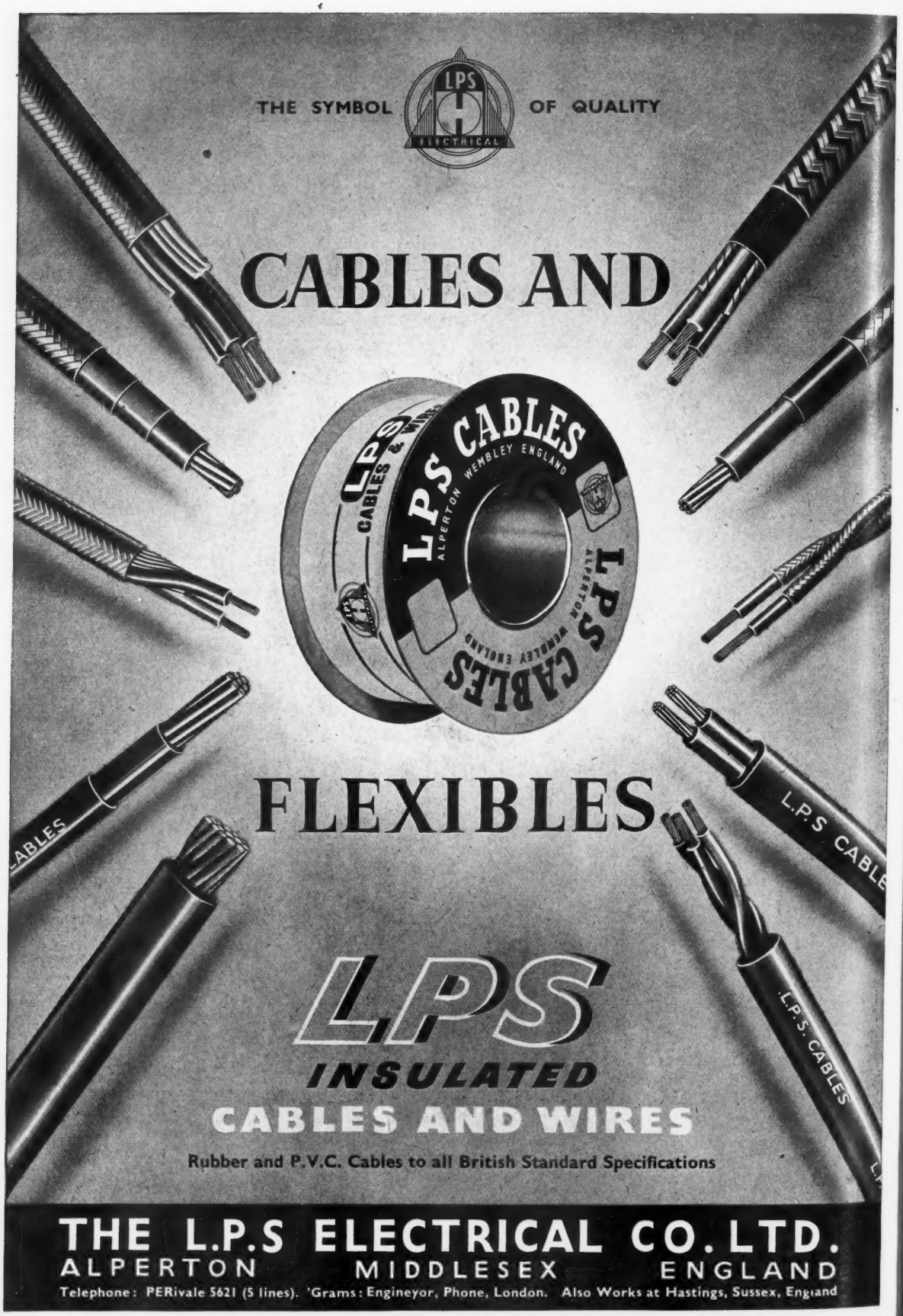
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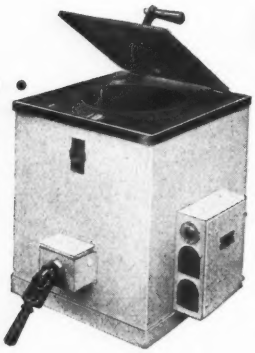

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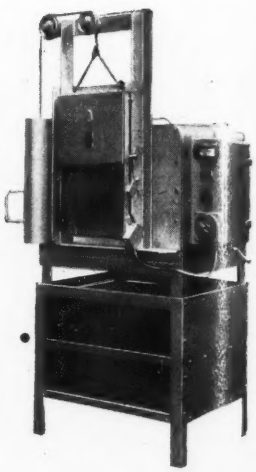

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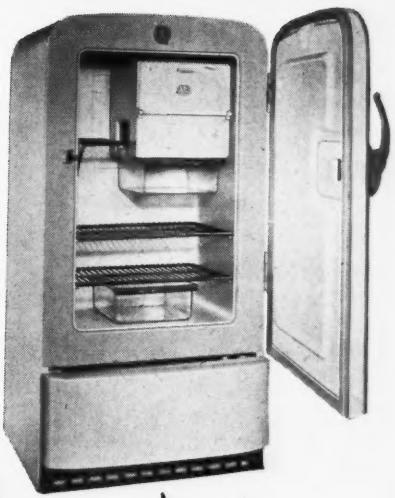

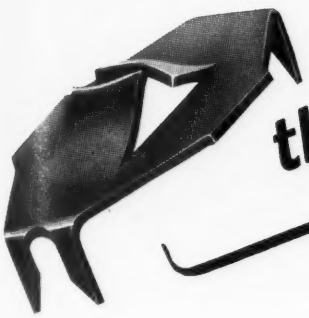

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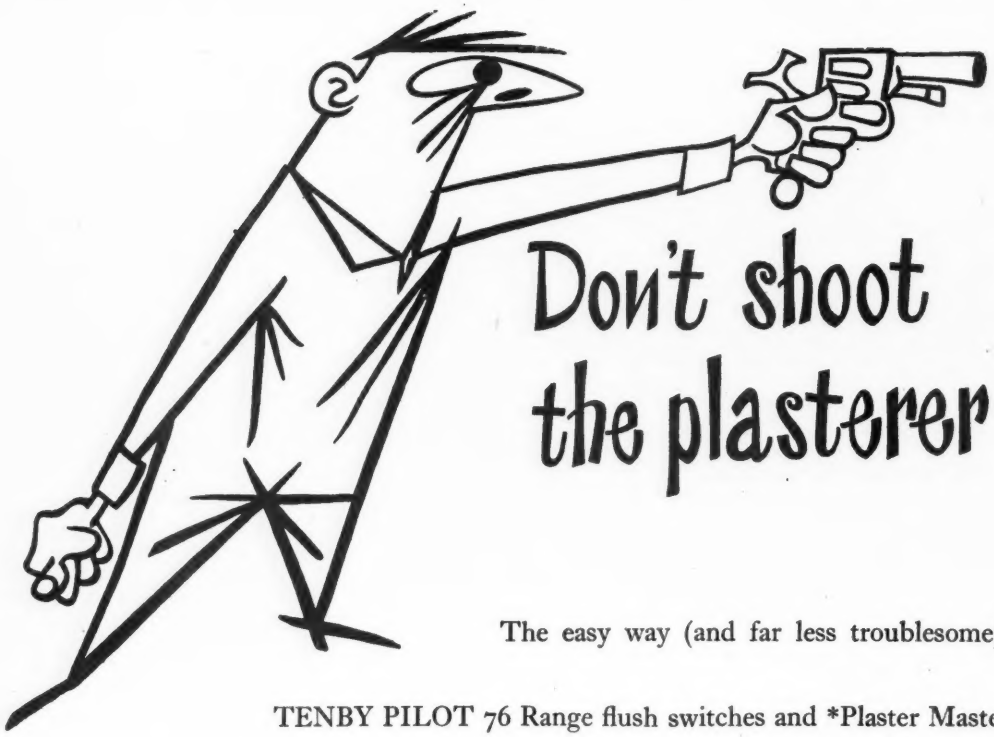

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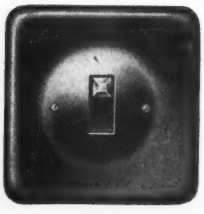
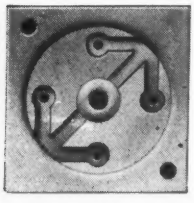
Reasonably priced and of an unusually attractive pattern.

We will be pleased to send you full details.

*Plaster depth of course*



## Tenby PLASTER MASTER



**S. O. BOWKER LIMITED**

19-21 WARSTONE LANE, BIRMINGHAM 18

*Telephone : CENtral 3701*

# SMOKE

RADIOVISOR
EST. 1927

## SMOKE DENSITY RECORDERS

**The agreed first essential for smoke-controlled combustion**

*Used by leading Industrial Companies for the past 25 years*

Public opinion is now demanding Government action for diminution of smoke. A fuel burning plant should *not* make excessive smoke if it be fired correctly. The Radiovisor Smoke Density Indicator operates during the whole 24 hours. It indicates and records the density of smoke emitted and shows the operator when attention is needed. In addition, an accurate record is available showing if efficient combustion with the minimum of smoke is being maintained and the Management have evidence *to prove* they are not contributing to air pollution.

***There is a range of standard equipment to cover all sizes and types of installations.***

*Further particulars from :*

**RADIOVISOR PARENT LTD**

*THE FIRST NAME IN PHOTO-ELECTRIC CONTROLS*

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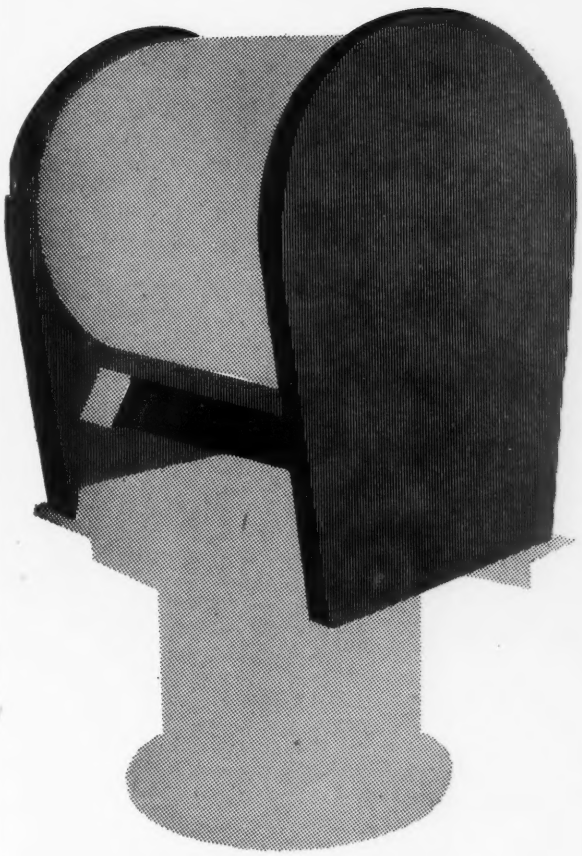

**where strength is vital**

# IT PAYS

**to insulate with**

# PERMALI

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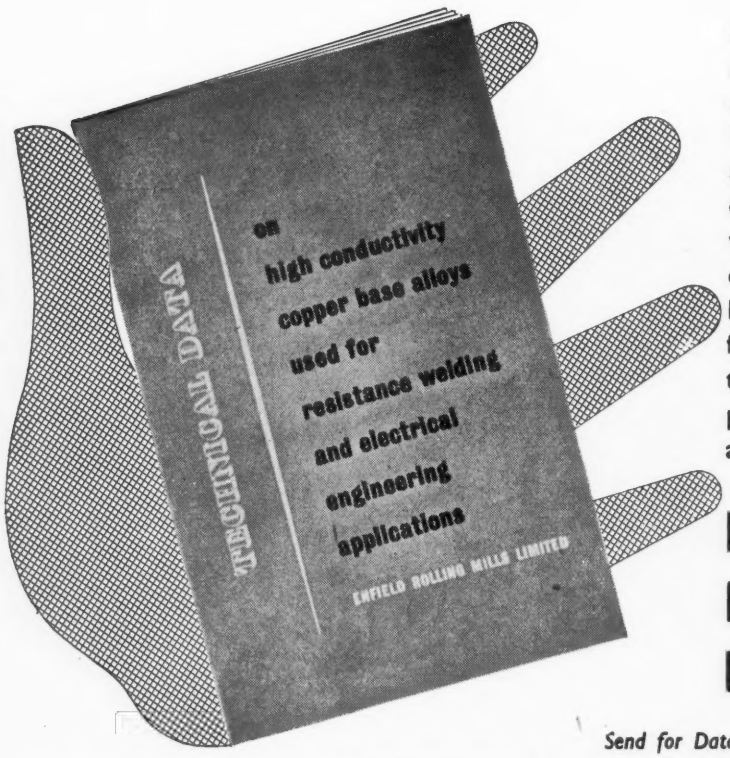


ERM High Conductivity Copper, Base Alloys for Electrical Engineering and Resistance Welding Applications.
We manufacture a wide range of alloys giving high strength with good electrical conductivity combined with resistance to softening at elevated temperatures.
ERM Alloys are available as strip, bar, forgings or castings. We specialise in the production of finished machined parts from High Conductivity Copper and any of the ERM alloys.

**ENFIELD ROLLING MILLS LIMITED**

*Send for Data Book giving full technical details.*

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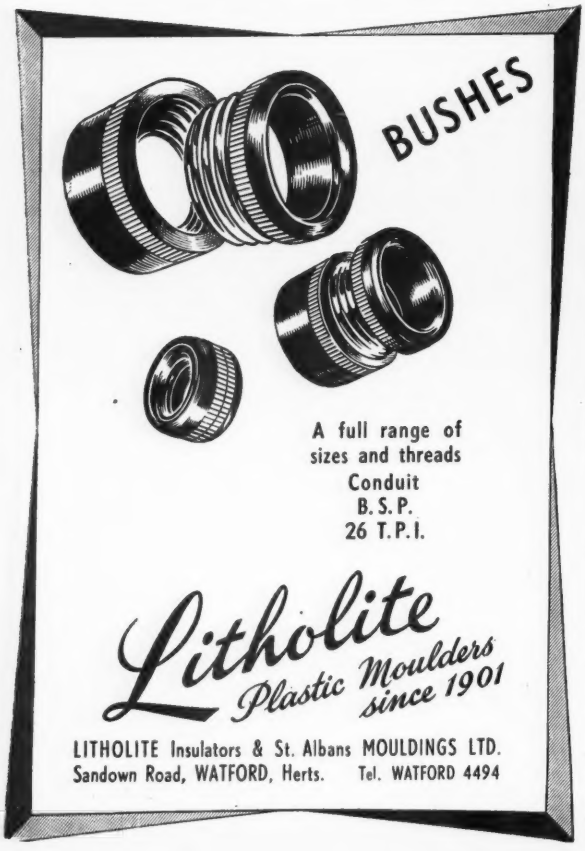


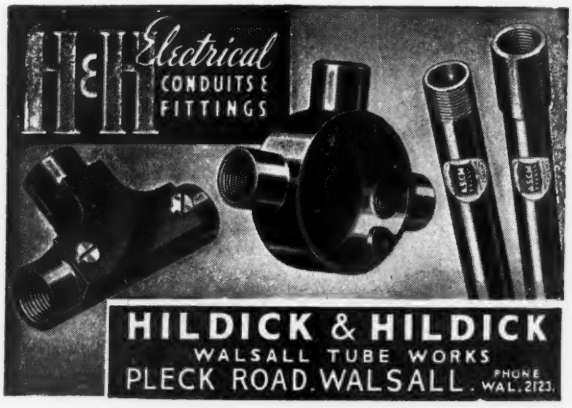

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## Wolf 3" PRECISION *Internal & External* LATHE GRINDER TYPE GL3

**Saves large capital outlay**

**Quickly repays low cost**

**Fits any normal 6″ to 8″ lathe also planer and shaper**

**Grinds to closest precision limits**

### TYPICAL APPLICATIONS

Grinding hardened bushes, plug gauges, blanking dies, general tool room work sharpening slitting knives, milling cutters and reamers, also brake drum grinding.

### SPECIFICATION

| | |
|---|---|
| Motor | ·4 h.p. |
| Spindle Speed | |
| For external grinding | 8,000 r.p.m. |
| For internal grinding | 20,000 r.p.m. |
| Watts input on full load | 495 watts |
| Nett weight | 18 lbs. |

The Wolf GL3 adapted for internal grinding

*Obtainable from all leading Tool Merchants*

## *Insist on* Wolf ELECTRIC TOOLS

**WOLF ELECTRIC TOOLS LTD · PIONEER WORKS · HANGER LANE · LONDON · W.5**

Telephone: PERIVALE 5631-4 Branches: BIRMINGHAM · BRISTOL · GLASGOW · LEEDS · MANCHESTER · NEWCASTLE

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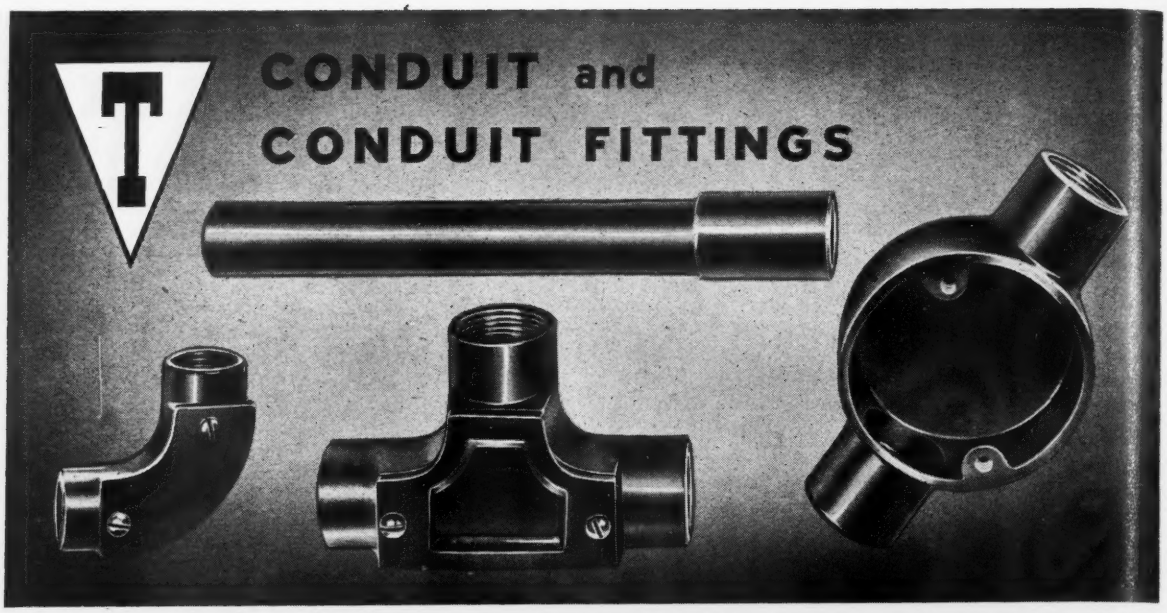


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*Complete equipment for*

ABRASIVE BAND POLISHING
WITH IDLER BACKSTAND

Abrasive band polishing provides high speed production, with greater efficiency and economy than conventional wheel polishing. Advantages include:—

(1) Long life of bands compared with set-up wheels.

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(3) Faster cutting.

(4) No waiting for set-up wheels to dry.

(5) Quick changing of bands and contact wheels when required.

Write for illustrated leaflets.

Floor Type Idler Backstand coupled to a Canning Polishing Motor.

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**May we have your enquiries for:—**

Paper Insulated cables, all types up to and including 22,000 volts.

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Tough rubber sheathed Trailing Cables

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All types Mining Cables

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Varnished Cambric

•

H.S.O.S. and P.B.J. having copper, aluminium alloy or all aluminium conductors

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V.I.R. Taped, braided and compounded to BSS 7/1953

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In other situations than this, also, the smaller independent unit will be found 'one hop ahead'.

In the making of good electric cables, for instance, at a price-to-suit-the-problem . . . We at

# Britannic Cables

pride ourselves on our freedom of action.
It allows us to 'meet' our customers in all sorts of ways but not to compromise with quality.

## Britannic Cables carry the load

BRITANNIC ELECTRIC CABLE & CONSTRUCTION COMPANY LTD., IVER, BUCKS

use the *New*

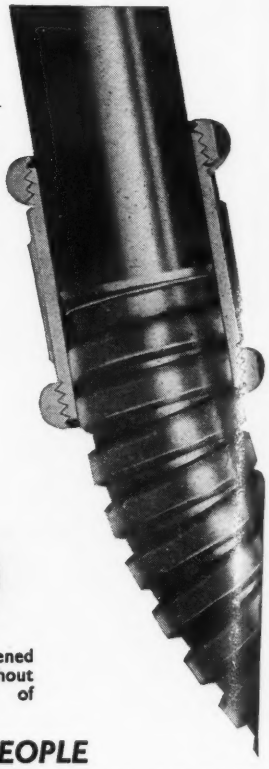
# ABCON conduit coupling

*(Approved by the London Electricity Board)*

*Just slide on the Abcon fitting, tighten up, and the joint is made.*

The greatest advance in conduit technique for years. The new ABCON conduit coupling is one of the most important advances that this field of electrical work has seen for many years.

**HOW IT WORKS. Tightening of the taper-threaded nut tightly contracts the slotted end of the ABCON fitting to the conduit.**



For joining rigid to flexible conduit (of same outside diameter of rigid conduit).

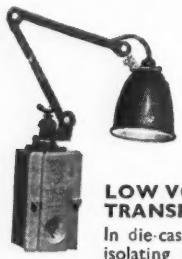
For joining rigid to rigid (no screwing of conduit required)

Supersedes inspection elbows. Sound bonding.

Joints may be opened at any point without dismantling run of conduit.

**ABBOFLEX LIMITED — *THE FLEXIBLE CONDUIT PEOPLE***

**FERRY ROAD, TEDDINGTON, MIDDLESEX** **TELEPHONE KINGSTON 9159**



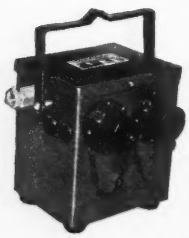
# *Electrical* EQUIPMENT

**LOW VOLTAGE LIGHTING TRANSFORMER**

In die-cast Aluminium Case, Self-isolating fitted with D.P. on-off Switch and H.R.C. Fuses to B.S.S. 794/38. Can be supplied with 1, 2 or 3 arm Lighting Brackets or Low Voltage Plugs and Sockets.

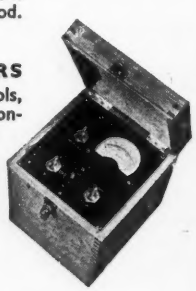
**MEDIUM VOLTAGE ALL INSULATED TEST LAMP**

100 — 500 Volts. A.C. D.C. Fitted with H.R.C. Fuses in each prod.



**PORTABLE TRANSFORMERS**

For portable m/c tools, handlamps, etc., Secondary Voltages from 12 V — 110 Volts. Capacities from 50 V.A. to 750 V.A.



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For testing earth fault loop resistance — 2 models available.

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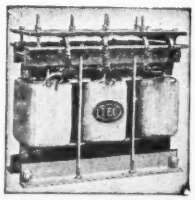

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93 IRVING ST. BIRMINGHAM 15

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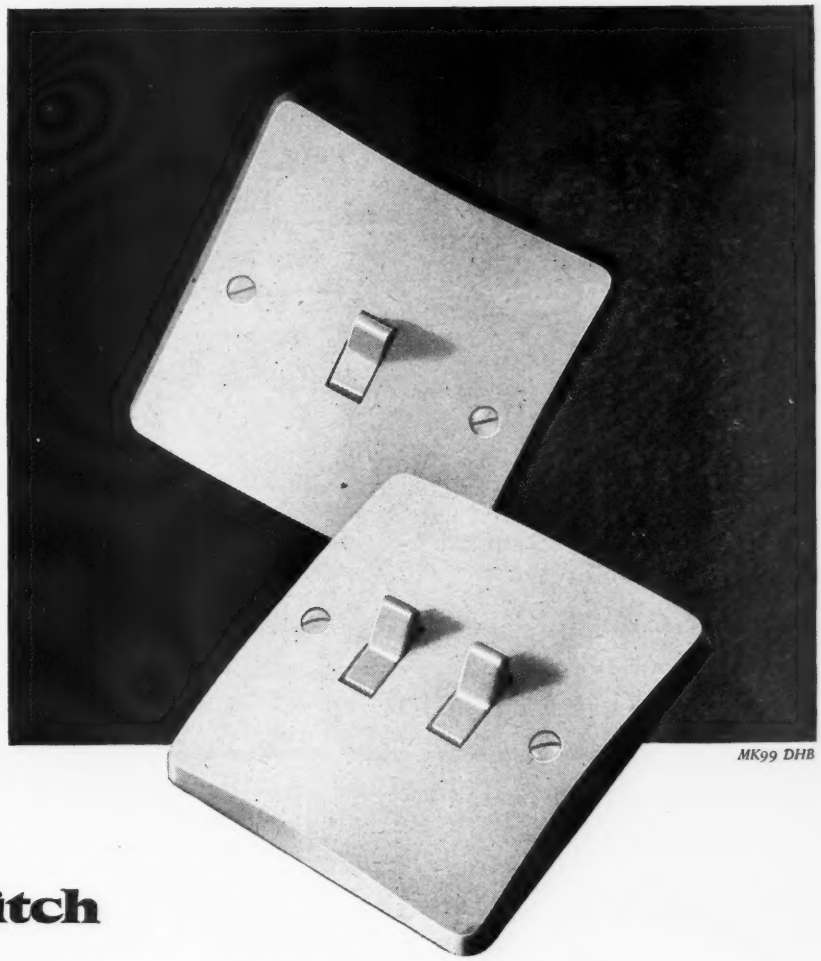
for modern housing



MK99 DHB

# the **Plateswitch**

*. . . setting new standards in value and reliability*

Every detail of the distinctive new **Plateswitch** is worth studying. The quality of the materials and the finish bear the closest possible inspection. Installation is made easier by provision for automatic levelling with the plaster and generous and well-positioned terminals. Both one and two gang patterns have BS 1299 fixing centres. The action is positive, yet the **Plateswitch** is easily operated in silence. In its clean modern lines, too, the **Plateswitch** is right up to the minute.

**THESE EXTRA ADVANTAGES SIMPLIFY STOCKING**

★ Every **Plateswitch** is supplied with four screws to match—two 4BA for metal boxes and two No. 5 wood screws for wood boxes.

★ The two gang **Plateswitch** has two 2-way switches only, each or both of which can be wired as 1-way.

*Ask for leaflet 227 and compare the value.*

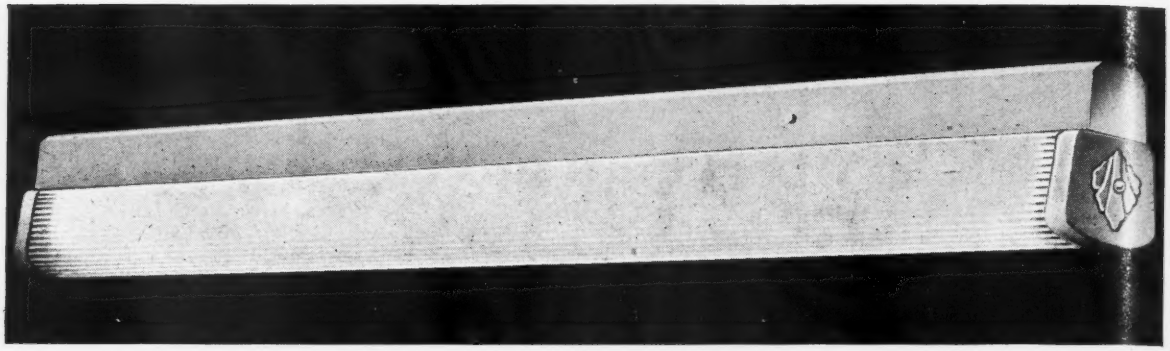
MK REGD *. . . the mark of leadership*

M. K. ELECTRIC LIMITED, WAKEFIELD STREET, LONDON, N.18. *EDMONTON 5151*

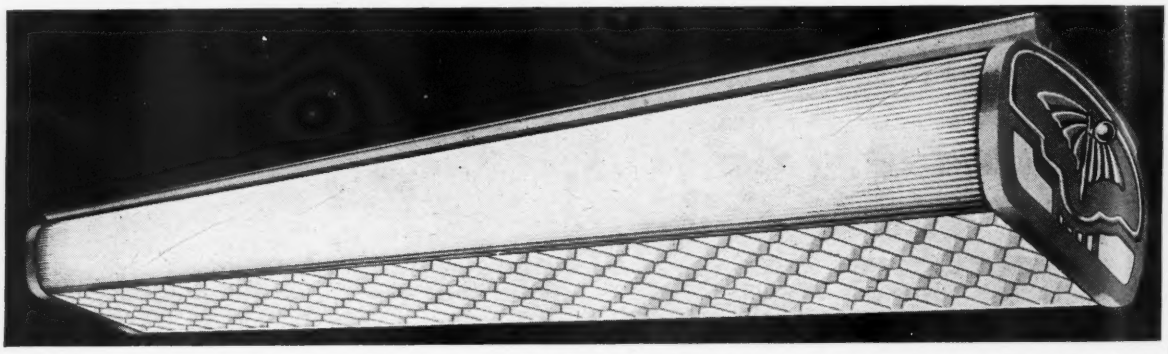
# *Decorative Lighting*

## *with*

## TECHNICAL EFFICIENCY *in 5', 4' or 2' Fluorescent Fittings!*



**F51231**—*Reeded perspex diffuser fitting with decorative metal ends, totally enclosed, with control gear incorporated. Available in 5ft., 4ft. and 2ft. single or twin lamp.*



**F52222**—*Reeded perspex diffuser fitting with decorative metal ends. Either complete or open diffuser or with plastic louvre. Available in 5ft., 4ft. and 2ft. single, twin or triple lamp.*

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## DECORATIVE FLUORESCENT FITTINGS

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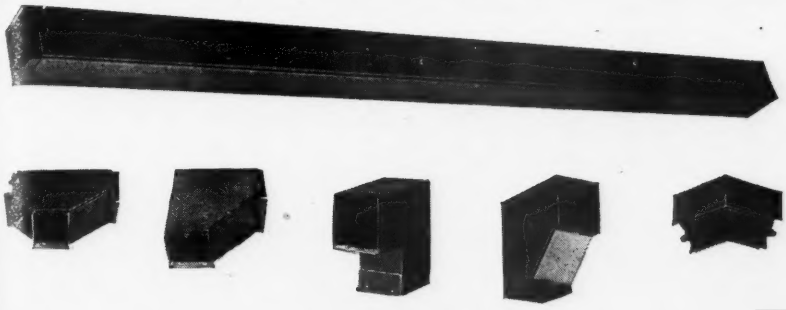

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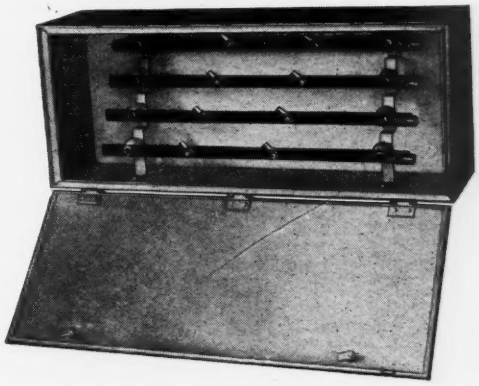
PATENT No. 511647

# ELECTRICAL EQUIPMENT FOR INDUSTRY

## CABLE TRUNKING

FULL RANGE OF FITTINGS AVAILABLE
RANGE OF STOCK SIZES:—
3x2, 3x3, 4x2, 4x4, 6x3, 6x4, 6x6

**MANUFACTURED IN 16 s.w.g. ZINC COATED STEEL**



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**LENGTHS FROM 12 ins. UPWARDS. 125 amps. TO 1000 amps.**

## Manchester Area Distributors:

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**Manufacturers: Mantel Metalworkers Ltd.**
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CANTIE

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MINUNIT switchboards are *unit-built throughout* from stocked components. Each unit, whether in the housing or in the included equipment, is based on a *single standard dimension*. The housing, made up from carefully-tooled channel-steel framework and covers, provides appropriate single-unit or multiple-unit apertures, into which the switching and control equipment is fitted. Full access is available from the front of the switchboard. MINUNIT switchboards are flush-fronted and house all kinds of distribution equipment; they can be modified or extended easily and simply, without wastage of material; yet MINUNIT switchboards are always neat, always complete, and — being naturally symmetrical — are always extremely pleasing in appearance.

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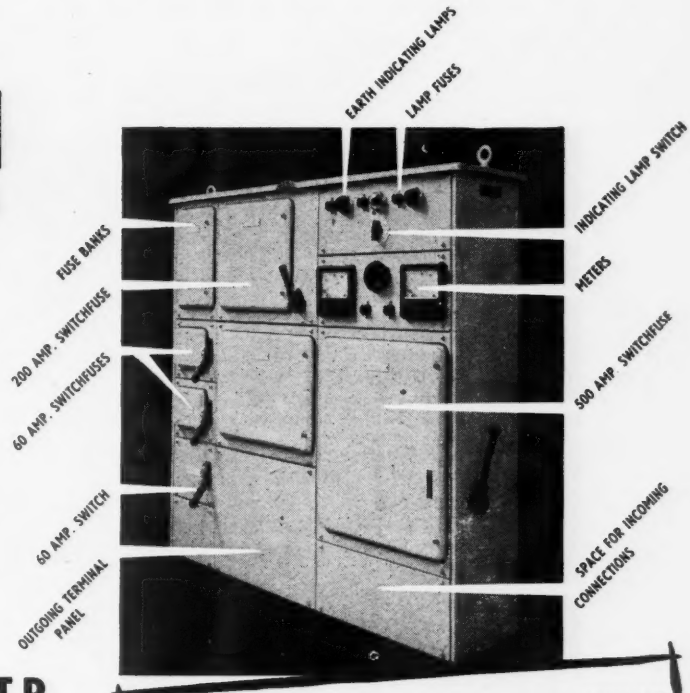


**UNITS OF STANDARDISED DIMENSIONS**

**CANTIE SWITCHES LTD**
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*One of the METAL INDUSTRIES GROUP of industries*

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Domestic
Aluminium
Ware
of this quality
on display
must *sell*

Must *sell* for you
again and again

Many housewives are now using electric cookers for the first time, and first impressions are vitally important in establishing the popularity of electric cooking. *For maximum efficiency the right kind of utensil is essential.*
PYRAMID policy of designing the best utensil for electric cooking makes maximum speed and economy certain.
In the showroom too, PYRAMID quality makes an instant appeal, increasing showroom sales and creating satisfied consumers.

**TWO RANGES TO COVER ANY TYPE OF COOKING:**
Pyramid Ground Base gives the best results on solid hotplates.
Pyramid Black Ground Base is designed for cookers with radiant or mixed radiant and solid hotplates.

## Have you progressed to Pyramid?

PYRAMID ALUMINIUM WARE

**HAGUE AND McKENZIE LIMITED, PYRAMID WORKS, SLOANE STREET, BIRMINGHAM 1**

# RUBBER CABLES & FLEXIBLE CORDS

"C.M.A." Cables insulated with natural rubber compounds have been proved over a period of more than fifty years. Their long life, the ease with which they can be installed and their flexibility over a wide range of temperatures are only some of the merits which have led to their widespread use for power and lighting purposes. Special applications include cables for aircraft, ships, welding, railway signalling, neon signs, also trailing cables for mines and quarries.

The C.M.A. has more than 20 years' experience with synthetic rubbers, and as a result cables can be offered which are resistant to burning, to weather, and to a variety of acids, alkalis, and oils. Suitable cables are also available for high temperatures.

*The 'Roman Warrior' and letters 'C M A' are British Registered Certification Trade Marks*

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**SPECIFY C·M·A CABLES**

**CABLE MAKERS ASSOCIATION, 52/54, HIGH HOLBORN, LONDON, W.C.1**

The new 28 station
mechanical transfer
gearbox machine at
MORRIS MOTORS
shown above
is powered by

39 Newman
MOTORS

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL, ENGLAND
BRANCHES IN MOST PRINCIPAL CITIES

Cogent

# Presenting a complete range of BELLS, BUZZERS and TRANSFORMERS for Domestic and Industrial application

**Fig. 396 "UNDERDOME" BELL**
A very popular bell of unique design, available with 3" or 4" dome.
Retail Price (3" dome) A.C./D.C. 3-4½ v. 7/4d.
Prices for other voltages on application.

GENTS' OF LEICESTER

**Fig. 398 "ALL-IN-ONE" BELL**
An ideal Domestic Bell. Battery under snap-on cover. Bell movement under 3" gong.
Retail Price: 11/6d. (Battery extra).

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**Fig. 382 "TWO-IN-ONE" BELL**
Dual purpose bell. "Ring" and "buzz" from same unit. A.C. operation through small transformer.
Retail Price: 14/8d.

**Fig. 391 BAKELITE CASED BELL**
Conventional Bell for battery or transformer working as ordered. Can be supplied with Dome, Church or Sheep Gong.
Retail Price (3-4½ v. D.C.) Dome Gong: 10/2d.

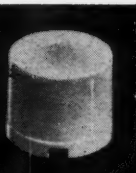

**Fig. 384**
**MINIATURE DUO-TONE BUZZER**
Very efficient buzzer for operation on D.C. for high pitch, A.C. for medium pitch, or both from two pushes.
Retail Price (3-4½v DC and 8v AC) 7/-

**Fig. 1079**
**SURFACE DIS-CO-BELL**
A 7" resonant disc gong. Gives a distinctive note. Small projection, bronze finish. Flat battery inside or transformer working.
Retail Price: 40/-

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**Fig. 1132 TRANSFORMER**
Air-cooled single phase transformer. Case tapped ½" conduit entry. Fused secondary. Primary and secondary windings to suit requirements. Output up to 200 VA. Prices on application.

GENTS' OF LEICESTER

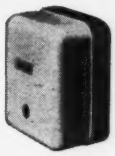


**Fig. 1139 TRANSFORMER***
Suitable for Bells and Domestic "Chimes."
OUTPUT 2 AMPS.
Retail Price: 18/-

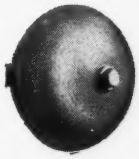


**Fig. 1065 UNDERDOME BELL**
8" Industrial Bell with movement under Cast steel gong. Models available for Battery, A.C. or D.C. for voltages up to 250.
Prices on application.

**These products mean Business — our Domestic models are contained in attractive "fast selling" packs.**

**Write for our latest priced Catalogue giving full details of these and other similar products. Ask for Book 1 Section 2.**

**Fig. 145 METALCLAD BELL**
Very popular Industrial Bell. Models for Battery, A.C. or D.C. up to 250 v. Dome, Sheep or Church gongs in Steel or Bell metal.
Prices on application.

*An entirely new transformer ideally suited for Industrial and Domestic applications. Sheet steel cover stove enamelled cream with black plastic base. Fused secondary.

GENTS' OF LEICESTER

**ELECTRICAL PRODUCTS**

GENT & COMPANY LIMITED · FARADAY WORKS · LEICESTER

*Manufacturing Electrical Engineers since 1872.*

London Office and Showrooms: 47 Victoria Street, S.W.1. Also at: NEWCASTLE · BIRMINGHAM · BRISTOL & GLASGOW

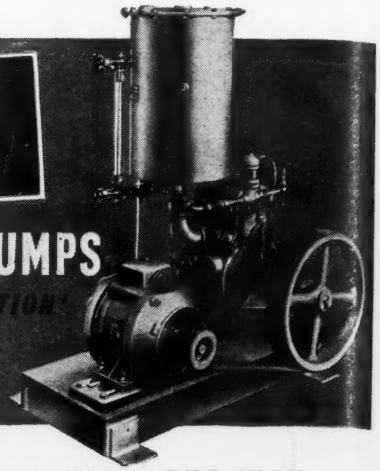
*Other products include:* INDICATORS · FIRE & BURGLAR ALARMS · LUMINOUS CALL SYSTEMS · STAFF LOCATORS
CONTROLLED ELECTRIC CLOCK SYSTEMS · TIME RECORDERS, ETC.

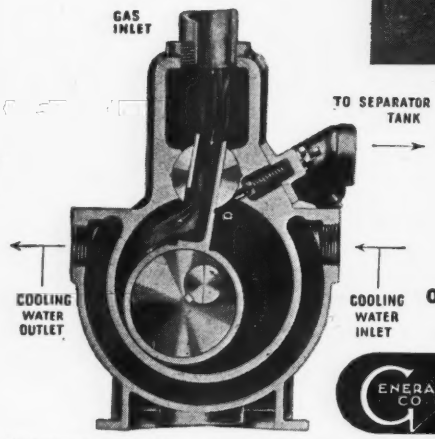
NEW IDEAS SOLVE OLD PROBLEMS

# Kinney

## HIGH DUTY VACUUM PUMPS

FOR ECONOMICAL PRODUCTION PROCESSING






**KINNEY VACUUM PUMPS SHOW THE WAY**

Has it ever occurred to you that Kinney Vacuum Pumps might well solve *your* problems? Cathode ray tubes, electric lamps, coated lenses and mirrors, drugs, foodstuffs, coated foils, condenser papers, electrical components—these are a few of the products now being made quicker, better and more profitably, thanks to Kinney Vacuum Pumps. Models VSD and DVD single stage (10 microns absolute pressure or better); model CVM double stage (0·5 micron or better), displacements 15 to 700 c.f.m. Bulletins 101 and 104 tell you all about them

**OPERATING CYCLE OF KINNEY VACUUM PUMP**

The plunger, moving in the direction of the arrow, rapidly creates space into which gas is admitted through the inlet valve. Simultaneously, gas previously trapped is being compressed. When the plunger reaches its highest position, air or gas and surplus sealing oil is expelled through the outlet valve and nozzle into the oil separator tank. There, the oil is retained and the air or gas discharged to the atmosphere. Further movement of the plunger closes the inlet valve and completes the cycle of operation.

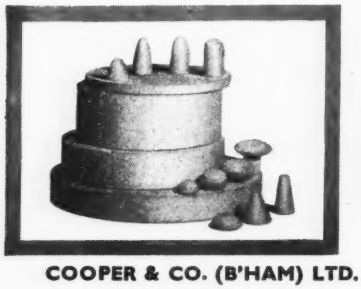
GENERAL ENGINEERING CO. (RADCLIFFE) LTD.

**STATION WORKS, BURY ROAD, RADCLIFFE, LANCS.** Telephone: Radcliffe 2291 (3 lines) Telegrams: "General, Radcliffe"
*London Office: 3rd Floor, 9 Victoria Street, London, S.W.1. Telephone: ABBey 5278*

---

# 1½ MILLION GOOD 'TURNS DAILY

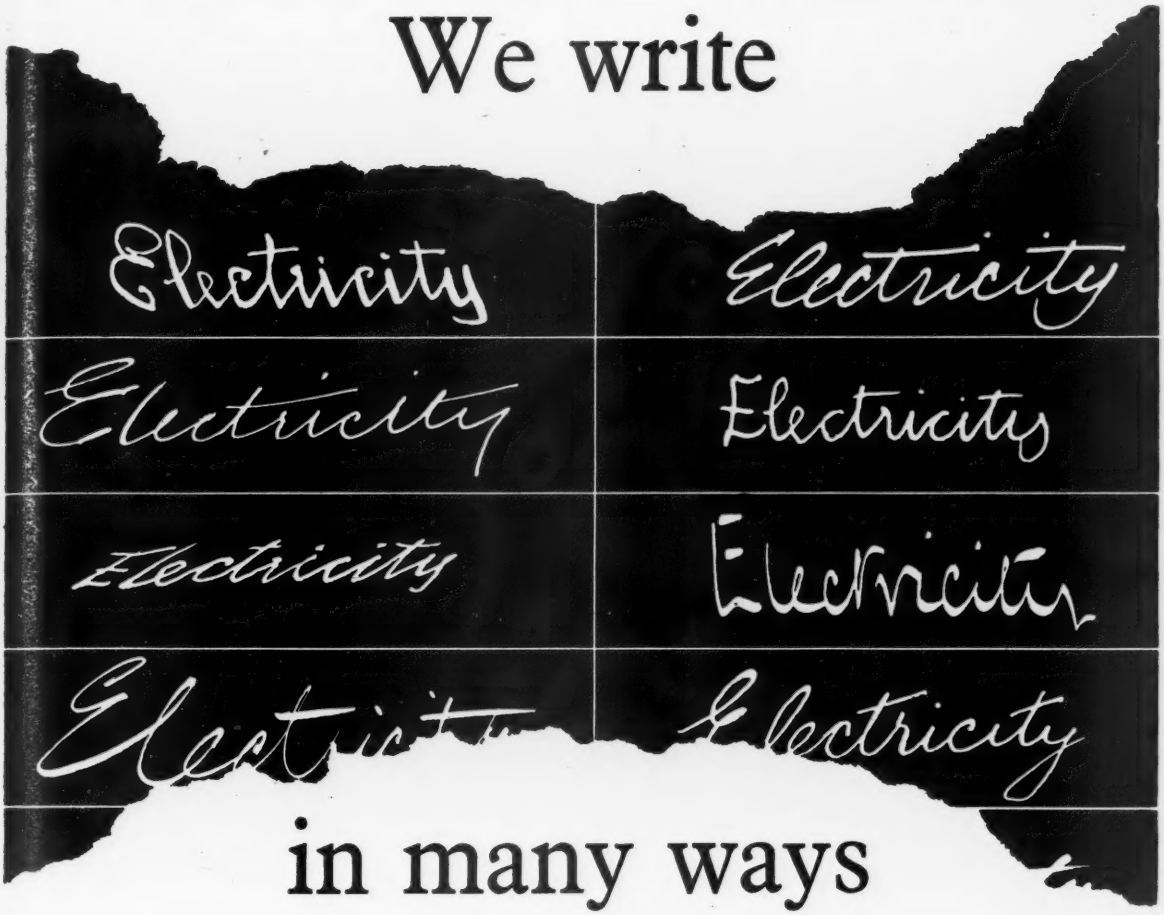
Do you know that many Coopers Polishing Bobs run at speeds in excess of 100 miles an hour (528,000 surface-feet)? No wonder they have to be made as only Coopers know how. Send for our free brochure today, illustrating the ideal wheel for every class of work.



**COOPERS FELT**

**COOPER & CO. (B'HAM) LTD.**
**BRYNMAWR, Breconshire**
Tel.: Brynmawr 312. Grams: Felting Brynmawr
Registered Office & Works: Little King St., Birmingham 19

# We write




# in many ways

**but our spelling is invariable**

Every day of the year we write or type the word *electricity* many thousand times. On paper, the word may always look the same but, in fact, electricity appears to us as twelve different entities. The twelve sections of the Crompton Parkinson organisation each have a specialist job to do. Between them they cover every aspect of electrical equipment and installation. United they provide the customers of Crompton Parkinson with the finest electrical service in the world.

**When it comes to electrical equipment . . .**

**you've got to hand it to** **Crompton Parkinson** LIMITED

ELECTRICAL EQUIPMENT

MAKERS OF ELECTRIC MOTORS OF ALL KINDS · ALTERNATORS · GENERATORS · SWITCHGEAR · B.E.T. TRANSFORMERS · CABLES INSTRUMENTS · LAMPS · LIGHTING EQUIPMENT · BATTERIES · STUD WELDING EQUIPMENT · TRACTION EQUIPMENT

CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON · W.C.2 · TELEPHONE: CHANCERY 3333

**Built by Craftsmen .....** Assembly of Scalamp Galvanometers Cat. Nos. E.R. 7901/S-4/S

# *The* SCALAMP *Range*

## GALVANOMETERS • FLUXMETERS • ELECTROSTATIC VOLTMETERS

The illustration above shows the operator 'balancing the coil' of a "SCALAMP" GALVANOMETER—one of the final operations in its construction. This instrument, available in a range of sensitivities and incorporating a built-in four-position shunt, is one of the most versatile instruments of its kind. Housed in a robust dust-proof plastic case, it can be operated from mains or battery supply. Two new features, namely a slow-motion drive to the zero control, and an automatic self-shorting foot have recently been incorporated.

The truly functional design of the case with built-in lamphouse, transformer and scale renders it adaptable to other instrument types. A FLUXMETER of exceptional performance and a series of ELECTROSTATIC VOLTMETERS (ranges 1-5, 3-10 and 5-18 kV) have already been introduced and a MEGOHM-PER-VOLT VOLTMETER is under development.

Details of the "SCALAMP" range will gladly be sent on request.

STANDARD EQUIPMENT IN MANY LEADING LABORATORIES

# SCIENTIFIC PYE INSTRUMENTS

W. G. PYE & CO. LTD. GRANTA WORKS · CAMBRIDGE · ENGLAND

W.G.54

# THIS CONSOLE IS IN OUR STANDARD RANGE

Reg. des. app. No. 870311

It is robustly constructed and has excellent ventilation.
Front panels of 10 S.W.G. steel bolts to standard G.P.O. drillings
The top is of grey linette, burn proof, formica.
Chassis runners and handles can be supplied as an extra.
It is one of our range of standard metal cabinets, cases, racks and consoles.

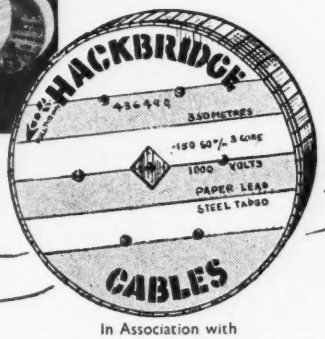
SEND TO DEPT. E
for illustrated Catalogue
of our standard range.

**IMHOFS**

112-116 NEW OXFORD STREET, LONDON, W.C.I. MUSEUM 7878

# YET ANOTHER SHIPMENT

*of HACKBRIDGE Cables to forge the vital links of Telephone, Power and Lighting in all parts of the world*




ELECTRIC CABLES OF ALL TYPES

**HACKBRIDGE** *Cable Company Limited*

In Association with
BRYCE ELECTRIC CONSTRUCTION CO LTD.

KELVIN WORKS • HACKBRIDGE • SURREY
BRANCHES AT BIRMINGHAM, BRISTOL, CARDIFF, MANCHESTER, NEWCASTLE, SHEFFIELD

# SOLDERING INSTRUMENTS
## AND ALLIED EQUIPMENT
**for factory, maintenance and instrument makers**

★ **MINIATURE**
JOINTING
becomes
a
★ **MINIATURE**
problem
with
**ADCOLA**
EQUIPMENT

**FACTORY BENCH LINE MODEL**
$\frac{1}{16}$" Bit
List No. 64

**INSTRUMENT MODEL**
With Collet held
$\frac{1}{8}$" Bit
List No. 70

*OTHER MODELS AVAILABLE*

Standard Volt ranges stocked
6/7 12/13 22/24 50/55 100/110 200/220 230/250

British, U.S., Canadian and Foreign Patents, also registered designs.

★
**ADCOLA**
**P.V.C. and POLYTHENE**
**ELECTRIC CABLE STRIPPERS**

Removes plastic insulation covering up to $\frac{1}{16}$" dia. cleanly and quickly. Eliminates "nicking" or abrasion of conductors. Readily fixed to bench or wall. Operates at flameproof temperature.

*ALSO IN ALL VOLT RANGES*

*Write for complete catalogue*

ADCOLA PRODUCTS LIMITED
(Regd. Trade Mark)

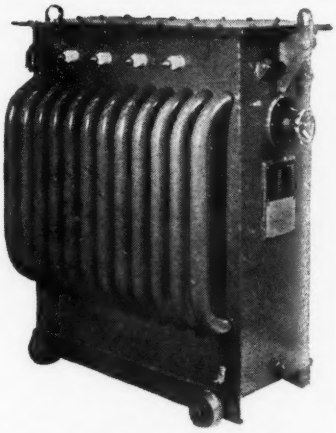
Head Office & Sales:
Gauden Road · Clapham High Street
London, S.W.4 *Phone: MACaulay 4272*



S T L
# TRANSFORMERS
## for Distribution and Industry

★ RECTIFICATION
★ PHASE CONVERSION
★ LOW VOLTAGE SUPPLIES
★ FURNACES
★ ARC WELDING
★ ELECTRONIC EQUIPMENT

**Ratings up to 250 kVA**



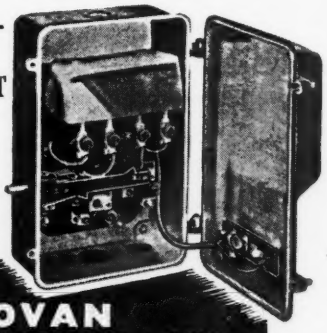
75 kVA, 400/200-600 V, 3 phase testing Transformer with off load tapping switch

***S.T.L.*** *Transformers are widely used in industry where reliable units are required for continuous duty*

**STEWART TRANSFORMERS LTD.**
Kilburn Lane London W.10 Tel. LADbroke 2296/7



FOR QUALITY-FIRST SWITCH, FUSE and MOTOR CONTROL APPARATUS



The **DONOVAN ELECTRICAL CO · LTD**
GRANVILLE ST. · BIRMINGHAM, 1



# MEKELITE
GEARED JOINT
**INDUSTRIAL LIGHTING UNITS**

For wall, bench or machine mounting. *Catalogue sent free on request.*

**MEK-ELEK** Engineering Ltd.,
17 Western Road, Mitcham, Surrey. MITcham 3072.

# These advertisements are selling for you in the following publications:

News of the World, Sunday Pictorial, Sunday Express, Woman, Woman's Own, Good Housekeeping, Picture Post, Home Chat, Home & Country, Ideal Home, My Home, Wife & Home, Woman's Pictorial, Woman & Home, Woman's Weekly.

Just what I've always wanted!
So quick, so convenient, so economical, life's so much easier now that I have my 'Swan Brand' Kettle.
It's a happy family with a
SWAN BRAND
ELECTRIC KETTLE
From Leading Stores and Electrical Dealers
In the home for a LIFETIME
Write for illustrated literature to Bulpitt & Sons Ltd., Dept. HC, Birmingham 18
M-W-346
In the home for a LIFETIME
SWAN BRAND
Ground Base
ALUMINIUM HOLLOWARE
THE ¼" FLAT BASE MAKES PERFECT CONTACT WITH HOT PLATE & CUTS CURRENT COSTS
Send for leaflet to Bulpitt & Sons Ltd. (Dept. NW), Birmingham 18
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*Keep sales moving with*

SWAN BRAND

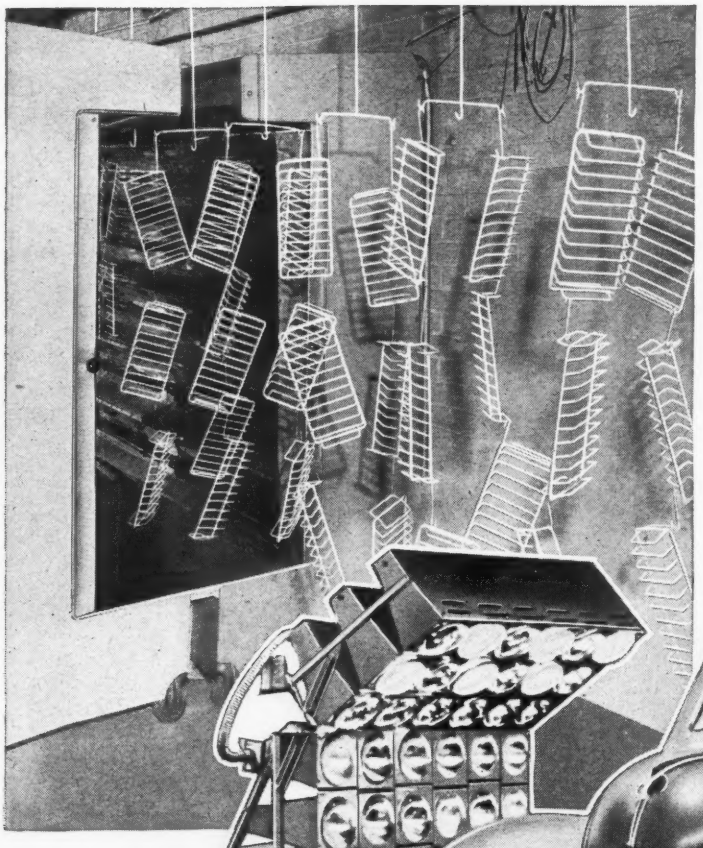
**ELECTRICAL APPLIANCES & GROUND BASE ALUMINIUM HOLLOWARE**

BULPITT & SONS LTD., ST. GEORGE'S WORKS, ICKNIELD ST., BIRMINGHAM 18

M-W-347

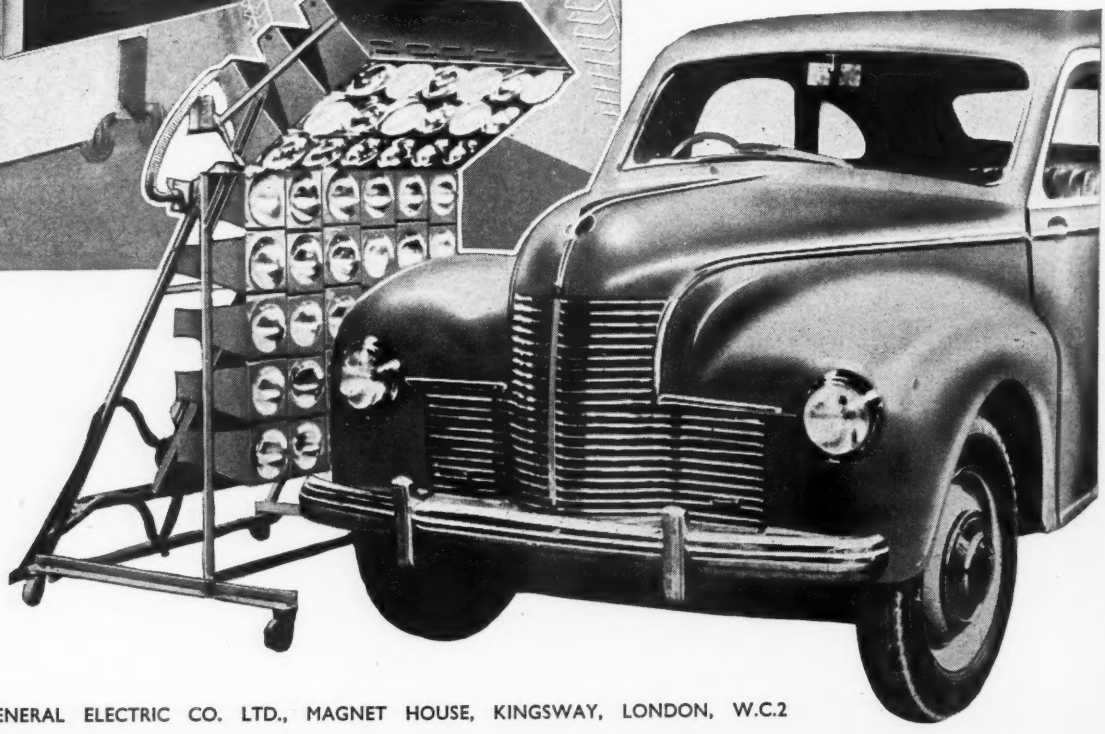
but not for long with G.E.C.

# RADIANT HEATING



## Stoves paint speedily– perfectly– lastingly!

Plate racks and car chassis — just two of a wide variety of products on which paint is stoved in a few minutes with G.E.C. Radiant Heating.



THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

# CLASSIFIED ADVERTISEMENTS

**ADVERTISEMENTS** are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

**CLASSIFIED** advertisements are PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

**DISPLAYED**:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

**SITUATIONS WANTED**:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

**REPLIES** to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

**Original testimonials should not be sent with applications for employment**

## CHRISTMAS

Classified Advertisements for the issue of 24th December should reach us by FIRST POST on FRIDAY, 17th DECEMBER.

## OFFICIAL NOTICES, TENDERS, ETC.

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

### CITY & COUNTY BOROUGH OF BELFAST

**Electricity Department**

TENDERS are invited for the supply and delivery of ANALYTICAL BALANCE, TITRATION BENCH & CONDUCTIVITY METER.

Specification (No. W.59) and form of tender may be obtained at the Electricity Department, East Bridge Street, Belfast.

Each tender, in sealed envelope marked "Tender for Analytical Balance, etc., Electricity Department," and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 30th December, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON, Chairman,
Northern Ireland Joint
Electricity Committee.

Chichester House,
Chichester Street, Belfast.
30th November, 1954. 6509

### MANCHESTER CORPORATION WATERWORKS

**Contract H.W.5**

THE Waterworks Committee invite tenders for the supply, delivery and jointing, etc., of approximately 2,000 lineal yards of Multi-Core Cable for automatic control purposes, etc., at the Haweswater Works, Westmorland.

Specification, etc., together with route plan, may be obtained on application to the Secretary, Waterworks Offices, Town Hall, Manchester, 2, on payment of the sum of one guinea, which sum will only be returned on receipt of a bona fide tender and all the documents lent.

Sealed tenders, endorsed as directed and addressed to the Chairman of the Waterworks Committee, Town Hall, Manchester, 2, must be delivered not later than 10 a.m. on Friday, 31st December, 1954.

PHILIP B. DINGLE,
Town Clerk.
Town Hall,
Manchester, 2.
30th November, 1954. 6467

### COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

TENDERS are invited for the Re-wiring of the Electrical Installation in the Harrogate Technical School and School of Art.

Specification and drawings, together with conditions of tender, may be obtained on application to the County Architect, Bishopgarth, Westfield Road, Wakefield, on payment of a deposit of £2 2s., which will be returned on receipt of a bona fide tender. Cheques must be made payable to the West Riding Treasurer and crossed "& Co."

Sealed tenders must be addressed to me, the undersigned, and received at Room 3, County Hall, Wakefield, not later than 10 a.m. on Monday, the 10th January, 1955.

BERNARD KENYON,
Clerk of the County Council.
6466

### NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

**Clunie Substation, Pitlochry**

TENDERS are invited for the provision of outdoor 132-kV Switchgear and ancillary equipment for Clunie Substation. Copies of the tender document may be obtained on application, with a cheque for £2 2s. (returnable), to the Engineers, Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1. The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.
16, Rothesay Terrace,
Edinburgh, 3. 6502

### HERTFORDSHIRE COUNTY COUNCIL

**Contracts**

THE Council invite applications for inclusion on their Approved List of Contractors for building and maintenance works, heating and electrical works, fencing works, etc. Tenders will normally be invited from a number of firms on the list, but the Council reserve the right to ask for other tenders.

Application forms from the Clerk of the County Council, County Hall, Hertford.

Contractors who have already applied for inclusion on the list need not apply again. 6511

### BOROUGH OF DAGENHAM

**Dagenham Town Show, 1955**

THE Council invite tenders for the supply of 110 New or Secondhand Vitreous Enamelled Steel Reflectors (open dispersive type) for use with 500-watt G.L.S. lamps.

Particulars and tender form from Borough Engineer and Surveyor. The Council do not bind themselves to accept the lowest or any tender. Closing date 22nd January, 1955.

KEITH LAUDER,
Town Clerk.
Civic Centre,
Dagenham. 6510

## SITUATIONS VACANT

***The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.***

### NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SENIOR ASSISTANT, REVENUE AND BANKING SECTION, CHIEF ACCOUNTANT'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER. Applicants should possess a recognised accountancy qualification and have a wide experience in accountancy, including preferably the preparation and completion of final accounts.

Salary scale £805/£895 p.a., Grade 7, N.J.C. conditions.

Applications to Establishment Officer, North Western Electricity Board, Cheetwood Road, Manchester, 8, by 18th December, 1954.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, BURNLEY DISTRICT. Duties will include general assistance in all commercial activities in the District. A sound knowledge of electrical installation work is desirable. Preference given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale £595 × £15 to £640 p.a., Grade F.11. N.J.B. conditions.

Applications to Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, by 18th December, 1954. 6471

### YORKSHIRE ELECTRICITY BOARD

**No. 2 (Huddersfield) Sub-Area**

SECOND ASSISTANT COMMERCIAL ENGINEER (Power Sales). Applicants should preferably be Corporate Members of the Institution of Electrical Engineers and must have had wide and responsible commercial experience in the industry, particularly in the development of industrial supplies, including negotiations with large power consumers and the formulation of Supply Agreements. They must be capable of advising potential industrial consumers on questions relating to fuel efficiency.

Salary N.J.B. Class K, Grade 7, £975/£25/£1,050 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 23rd December, 1954.

**No. 3 (Sheffield) Sub-Area**

GENERAL ASSISTANT ENGINEER (Communications), Meters, Testing and Protection. Applicants should be technically qualified to Higher National Certificate standard and have had experience in planning, installing and maintaining line tele-communication and remote control systems, and in the maintaining of radio telephone communication equipment. A knowledge of protective relays and systems will be an advantage.

Salary N.J.B. Class M, Grade 13, £755/£15/£800 per annum.

ENGINEERING DRAUGHTSMAN. Applicants should be first class draughtsmen, preferably with experience on mains recording with a Public Utility Authority, capable of compiling accurate and permanent records from particulars obtained on site, and carrying out survey work for the revision of ordnance maps and plans.

Salary N.J.B. Schedule D, Grade 6, £510/£20/£630 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 23rd December, 1954.

**No. 5 (Wakefield) Sub-Area**

CASTLEFORD DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER. Applicants must be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They must have had a sound practical training and extensive experience in the design, construction, operation and maintenance of H.V. and M.V. overhead and underground distribution systems, substation plant and ancillary equipment, preferably in a large undertaking.

Salary N.J.B. Class F, Grade 7, £755/£15/£800 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 12, Denby Dale Road, Wakefield, not later than 23rd December, 1954.

**No. 7 (Grimsby) Sub-Area**

GRIMSBY DISTRICT

DEMONSTRATOR. Applicants must have had a two years' full time course in domestic subjects at a recognised Training College and possession of the E.A.W. Certificate will be an advantage.

Salary N.J.C. Grade 1, £400/£490 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 23rd December, 1954. 6513

## SOUTHERN ELECTRICITY BOARD

### District Commercial Engineer

BASINGSTOKE District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class D, Grade 4 (£790 × £20 to £850). N.J.B. Conditions of Service. For classification purposes under the N.J.B. Agreement the Unit Assessment for the District was just under 48 millions in March, 1954.

Applicants must have had considerable experience on the commercial side of the electricity supply industry, especially in relation to rural development. They should possess a good knowledge of tariffs, sales, commercial statistics, electrical contracting and all aspects of consumer service. The possession of suitable technical qualifications would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 29th December, 1954.

### Assistant Engineer (Planning)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 9 (£675 × £15 to £720). N.J.B. Conditions of Service.

The duties of the post will be to assist the planning engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and the person appointed will be required to undertake standby duties if required. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than 29th December, 1954.

### Senior Draughtsman (Civil Engineering)

No. 1 (Southall) Sub-Area, Waterloo Road, Uxbridge. Salary N.J.B. Schedule D, Grade 5 (£672-£777 per annum, inclusive of London allowance). N.J.B. Conditions of Service.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings, and making calculations.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him not later than 29th December, 1954.

### Assistant Engineer (General)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£595 × £15 to £640). N.J.B. Conditions of Service.

Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, No. 1, Priory Road, Bournemouth, and returned to him in envelopes suitably endorsed, not later than 20th December, 1954.

### Junior Engineer

Aldershot District of No. 3 (Portsmouth Sub-Area. Salary N.J.B. Class F, Grade 14, commencing at £475 per annum. N.J.B. Conditions of Service.

Applicants will be required to assist in distribution duties including minor construction work and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment and possess suitable technical qualifications. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed, not later than 29th December, 1954.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible. 6512

## TRANSFORMER DRAUGHTSMAN

required for factory in Bridgend, Glamorgan. Experience in transformers up to 2,000 kVA, 33 kV, essential. Holidays with pay. Pension scheme. A new three-bedroomed house 2 miles from factory, 5 miles from Porthcawl, available for successful applicant. Apply — London Transformer Products Limited, L.T.P. Works, Cobbold Estate, Cobbold Road, Willesden, London, N.W.10. 6455

## THE MULLARD RADIO VALVE CO.

invites applications for the following vacancies in its Special Valve Division.

V.H.G. (A)—APPLICATIONS GROUP.

1. A SENIOR ELECTRONIC ENGINEER to control a group concerned with work on the fundamental problems connected with gas-filled valves.

An aptitude for the design of new circuits would be a particular advantage. In addition the appointment calls for a person who would be able to offer advice and assistance on the application of the finished product.

An essential qualification is an hons. degree coupled with practical experience in this or an allied field of work.

2. A PHYSICIST to work on fundamental problems connected with the application of gas-filled valves. The work will involve assistance and advice on the application of the finished product.

The minimum qualification for this appointment is an hons. degree of physics, and previous experience is desirable although not essential.

3. AN ELECTRONIC ENGINEER to work on specialised circuit problems associated with gas-filled valves. The successful applicant will, in addition, be expected to offer advice and assistance on the application of the finished product.

A B.Sc. pass degree or equivalent qualifications, together with experience in this or an allied field of work, is desirable.

V.H.G. (B)—EQUIPMENT DESIGN GROUP.

1. AN ELECTRONIC ENGINEER to supervise a group concerned with the design of equipment for the testing of gas-filled valves. The work will also involve giving advice and assistance in the construction of this type of equipment and to supervise the construction of experimental circuits to meet new demands and applications.

A B.Sc. pass degree or equivalent qualifications, together with some experience in this or an allied field, is desirable. Applications are particularly invited from candidates having an interest in circuitry.

2. A TECHNICAL ASSISTANT to design test equipment for gas-filled valves. The duties will involve the consideration of experimental circuits for use with these types.

Applications are invited from candidates who have experience in circuit techniques, and who should preferably possess a Higher National Certificate or equivalent qualifications.

The vacancies outlined above are at the company's Mitcham factory and are due to the expansion of its activities in this field. Salaries will be according to individual age, experience and qualifications and can be considered as progressive.

There are facilities for further training, a company pension scheme, long service plan, and conditions of employment generally can be considered to be of a high standard.

Applications in writing, which will be treated with the strictest confidence, should be addressed to the Personnel Officer, The Mullard Radio Valve Co. Ltd., New Road, Mitcham Junction, Surrey, quoting the appropriate reference number.

6526

## BRITISH ELECTRICITY AUTHORITY

### North West, Merseyside and North Wales Division

VACANCY No. 232/54/R: STATION SHIFT CONTROL ENGINEER, Padiham Generating Station. Salary £595 × £15 to £640 (E.10).

Vacancy No. 234/54/R: STATION SHIFT CONTROL ENGINEER, Buccleugh Street Generating Station, Barrow. Salary £555 × £15 to £600 (D.10).

Applications, quoting vacancy number, to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20, before 18th December. 6486

## MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, Sutton Coldfield and North East Birmingham District, Birmingham and District Sub-Area.

Duties involve assisting with enquiries and advising consumers at the Industrial Service Centre on the most suitable type of industrial electrical equipment for their purposes. Experience necessary in the application of electricity for industrial uses. Technical qualifications desirable. Salary £715/£760 per annum (N.J.B. Grade J.11). Applications stating age, qualifications, experience and present salary, endorsed "General Assistant District Commercial Engineer—Industrial" should be delivered within 14 days, to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

GENERAL ASSISTANT DISTRICT ENGINEER, Shrewsbury District, Shropshire and Herefordshire Sub-Area.

Experience necessary in all branches of distribution work including operation and maintenance of high and low voltage underground and overhead distribution systems. Technical qualifications desirable. Salary £595/£640 per annum (N.J.B. Grade E.10).

GENERAL ASSISTANT DISTRICT ENGINEER, Wellington District, Shropshire and Herefordshire Sub-Area.

The successful applicant will be required to assist in the construction and maintenance of E.H.V. and L.V. overhead and underground mains. Technical qualifications desirable. Salary £555/£600 per annum (N.J.B. Grade E.11).

Apply in writing within 14 days, stating age, experience, present salary and position to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

DISTRICT COMMERCIAL ENGINEER, Wednesbury District, South Staffs and North Worcs Sub-Area.

Applicants should have had extensive experience in the industrial and domestic aspects of commercial work including installations, public lighting and sales and service to the consumer. The duties will include development of industrial, commercial and domestic load, supervision and control of contracting department, preparation of specifications for electrical installations and public lighting schemes. Preference will be given to applicants who are Associate Members of the I.E.E. or hold equivalent qualifications. Salary £975/£1,050 per annum (N.J.B. Grade G.4). Applications received in response to previous advertisement will be reconsidered. Apply in writing within 14 days, stating age, training, qualifications, experience, present position and salary, to Mr. T. G. Keeler, Sub-Area Manager (Ref. CW), Midlands Electricity Board, Toll End Road, Tipton, Staffs.

A. STEPHENS,
Secretary.
6506

## TRANSFORMER DESIGNERS AND DESIGNER-DRAUGHTSMEN

BRUCE PEEBLES & CO. LTD., ENGINEERS, EDINBURGH, 5, have vacancies in their Transformer Department for the following appointments:—

(a) DESIGN ENGINEER with experience of transformers up to 10,000 kVA and interested in larger high voltage units.

(b) DESIGN ENGINEER with experience of, and particularly interested in, transformers up to 1,000 kVA.

(c) DESIGNER-DRAUGHTSMEN capable of undertaking complete electrical and mechanical layout of large high-voltage transformers and supervising detail work.

Application is also invited from Graduates, preferably with post graduate works experience, to undertake design and development associated with large power transformers.

Salaries commensurate with experience and qualifications; permanent appointment, with pension and production bonus schemes; five-day week; assistance in obtaining house accommodation.

Applications to Mr. R. W. Flux, Manager, Transformer Department, at above address. 6400

## BRITISH ELECTRICITY AUTHORITY

### London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with the N.J.B. Agreement, Schedule A or C. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for posts (b) an advantage.

(b) SHIFT CHARGE ENGINEERS, Barking "C" Generating Station (Vacancy No. 54/1011) and Deptford East Generating Station (Vacancy No. 54/1012). Practical experience in operation of power station plant essential. Character and ability to deal with staff problems essential. Salary Class J, Grade 7 = £945 p.a.

(a) ASSISTANT MAINTENANCE ENGINEER (Mechanical), Hackney Generating Station (Vacancy No. 54/1013). Candidates should have served an apprenticeship and be experienced in the maintenance of turbines, boilers and other mechanical plant. Salary Class H, Grade 9 = £792 15s. p.a.

(a) GENERAL ASSISTANT ENGINEERS (Efficiency and Testing), Groups 1 and 4 (Vacancy No. 54/1014). Candidates should have a good technical education and experience of the testing of mechanical plant in a power station. Salary Class AX, Grade 5 = £708 15s. to £924 p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, W.1, to be received within 14 days of this advertisement. 6521

## ENGLISH ELECTRIC CO. LTD.

THE CONTINUED EXPANSION of the Aircraft Equipment Division of THE ENGLISH ELECTRIC COMPANY has caused a number of additional vacancies on the Technical Staff of the Division, and applications are invited from both senior and junior engineers to fill the following grades of technical appointments:—

(1) SYSTEMS ENGINEER, capable of analysing system characteristics of both A.C. and D.C. aircraft specifying components. To be experienced in methods of protection, voltage regulation, load sharing, system stability, etc.

(2) CONTROL GEAR DESIGNER, experienced in design of contactors, circuit breakers, relays, etc., for both A.C. and D.C. systems. Ability to "miniaturise" designs a great asset.

(3) MAGNETIC AMPLIFIER AND TRANSDUCTOR DESIGNER, to be capable of designing these units to basic system requirements.

These are senior positions and applicants for the above should preferably be of degree standard, and at least H.N.C.

(4) ENGINEER OR PHYSICIST, with aerodynamic or thermo-dynamic experience which can be applied to heat exchange problems on electrical equipment.

(5) DESIGNER-DRAUGHTSMEN, experienced in mechanical engineering and control gear engineering.

(6) CONTRACTS ENGINEERS AND TECHNICAL REPRESENTATIVES. Technical Representatives should have had previous experience in the aircraft industry, but for ALL other appointments this is not necessary.

Please apply in confidence to Ref. No. S.A.47A, Dept. C.P.S., 336/7, Strand, London, W.C.2, with full particulars of past experience and qualifications, etc., and indicating interested appointment.

6249

## SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES

THE CIVIL SERVICE COMMISSIONERS invite applications for pensionable appointments. The Scientific posts cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. In biological subjects the number of vacancies is small: individual vacancies exist for candidates who have specialised in palæobotany, foraminifera, malacology and lichenology. The Patent posts are in the Patent Office (Board of Trade) and Ministry of Supply.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification; or, for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' postgraduate or other approved experience.

Age limits: Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted. For Scientific Officers and Patent Classes, between 21 and 28 during 1954 (up to 31 for permanent members of the Experimental Officer class).

Salary (London): Senior Scientific Officers (men) £975-£1,150, (women) £845-£1,025; Scientific Officers (men) £470-£855, (women) £470-£750; Patent Examiner and Patent Officer Classes (men) £440-£760 (rates under review). Women's rates somewhat lower. Somewhat lower rates in the Provinces.

Further particulars from the Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S/53/54 for Senior Scientific Officers and S.52/54 or S.128/54 for the other posts. Completed application forms must be returned by 31st December, 1954. 6437

## BRITISH ELECTRICITY AUTHORITY

### Midlands Division

SECOND ASSISTANT ENGINEER (Civil) is required in the Generation Construction Department at Wolverhampton. N.J.B. service conditions, superannuable appointment, salary with Schedule C, Grade 2 of the Agreement, commencing in range £950 to £1,075, ultimately rising to £1,165 per annum.

Applicants should have had considerable experience in the design and construction of heavy foundations and building works associated with modern generating stations; also in the preparation of preliminary schemes and estimates, specifications, bills of quantities for civil engineering and building works, writing of reports, and general control of building and civil engineering contracts. Sound theoretical and practical experience on large contract work is essential. Candidates should preferably be Corporate Members of the Institution of Civil or Structural Engineers.

Apply, quoting Vacancy No. 837MD on form A.E.6, available from the Establishment Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 29th December, 1954. 6519

## JOHNSON & PHILLIPS LTD.

require the services of a SENIOR CABLE ENGINEER in the TEST & RESEARCH DEPARTMENT. The position involves responsibility to the Research Manager for the supervision of all research and development work on all types of power cables. A good all-round experience of the manufacture, design and installation of power cables for all voltages is essential. Experience of gas pressure and oil-filled cables is also required. Experience in the design of cable accessories would be an added advantage.

The position would carry a good salary and good prospects.

Full details of training, qualifications and experience to date should be given. Apply Employment Manager, Victoria Way, Charlton, London, S.E.7.

6488

## BRITISH ELECTRICITY AUTHORITY

### East Midlands Division

APPLICATIONS are invited for the following positions within the Division:—

ASSISTANT SHIFT CHARGE ENGINEER (Boilerhouse), Longford Power Station, Coventry (Vacancy No. 181/54/ER.). Applications are invited from suitably qualified engineers to take charge of shift operation of boiler house plant.

Applicants must possess a sound technical training, have had good general engineering experience, a knowledge of the control and operation of large water tube boilers, ancillary plant and in the efficient combustion of fuels on chain grate stokers.

The salary will be within Class G, Grade 9 (£715 × £15 to £760 per annum) of the National Joint Board Schedule A.

Closing date for receipt of applications 16th December, 1954.

JUNIOR ENGINEERS, Freemen's Meadow Power Station, Leicester (Vacancy No. 185/54/ER.). Some experience in control room and boiler house work in a large P.F. station is required. Technical qualifications up to H.N.C.

Salary in accordance with Class H, Grade 16 (£475 × £15 to £520 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 23rd December, 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

3rd December, 1954. 6516

## THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

### Aldermaston, Berks

EXPERIMENTAL OFFICER or ASSISTANT EXPERIMENTAL OFFICER required for the development and testing of high-voltage cable connectors and experimental investigation of the application of casting resins to electrical and electronic problems.

The minimum qualification is Higher National Certificate in Electrical or Communication Engineering, and applicants for the Experimental Officer post should be at least 26 years of age.

The salary scales are: Experimental Officer, £690-£850 (male) per annum; Assistant Experimental Officer, £276 (at age 18) to £615 (male) per annum.

The successful applicant will be required to join the Authority's Principal Superannuation Scheme to be introduced shortly, and the salary scales quoted above will be enhanced to cover contributions. Houses will be available within a reasonable period for married officers who live outside the Establishment's transport facilities. An initial period of duty will probably have to be served at Fort Halstead, Sevenoaks, Kent.

Application form from Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote ref. 295/WGE/48.

6439

## METROPOLITAN-VICKERS ELEC. CO. LTD.

require DESIGN DRAUGHTSMEN for METALCLAD AND HIGH-VOLTAGE SWITCHGEAR DEVELOPMENT. Senior and Junior positions available according to experience.

Applications giving details of experience, age, etc., should be addressed to the Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17. 216

## GOLD COAST LOCAL CIVIL SERVICE

### Electrical Engineers, Gold Coast

VACANCIES exist for ELECTRICAL ENGINEERS in the Electricity Department of the Local Civil Service of the Gold Coast.

Duties are to take charge of, or assist in, the operation and maintenance of electricity supplies at voltages up to 11,000 volts. Appointments are on contract for 2 tours in the salary range £1,130-£2,020 per annum, point of entry depending on professional experience and age. A gratuity of £37 10s. is payable for each completed 3 months' satisfactory service.

Free first class passages are provided for the officer, his wife, and up to 3 children under 13 years of age. Government quarters, if available, are provided at a rental of £60-£90 per annum. Leave is granted at the rate of 7 days for each completed month of resident service after a tour of 18-24 months.

Candidates, between 28 and 45 years of age, should be A.M.I.E.E. or have passed or be exempt from Parts A and B of the examination for the Associate Membership of the Institution of Electrical Engineers, and have served a recognised apprenticeship in electrical engineering. They should have had five years' experience in power generation, transmission and distribution and consumers' installations, after obtaining the minimum professional qualifications.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith Street, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number BCD.145/13/02/D11. 6440

## BRITISH ELECTRICITY AUTHORITY

### South Eastern Division

### Croydon B Power Station

ASSISTANT ENGINEER (Operation and Efficiency), Class J, Grade 8, £840-£900 p.a. plus London allowance. Applicants who should possess a Higher National Certificate must have had experience in the operation of modern power station plant, plant testing and investigation and be familiar with the use of testing equipment.

ASSISTANT SHIFT CHARGE ENGINEER, Class J, Grade 9, £790-£850 p.a. plus London allowance. Applicants should have had a sound technical education and experience in the efficient operation of modern high pressure power station plant with P.F. firing, together with experience in the control of labour.

Applications for both positions to Station Superintendent, Croydon B Power Station, Beddington Farm Road, Croydon, Surrey, by 18th December.

### Divisional Headquarters Staff

THIRD ASSISTANT ENGINEER (Divisional Assistant Chemist), based at Croydon B Power Station, Class AX/DX, Grade 4, £750-£875-£950 p.a. plus London allowance. Applicants should possess B.Sc. or A.R.I.C. degrees, but consideration will be given to those with H.N.C. (Chemistry) having suitable industrial experience. Duties involve investigations into chemical problems related to power generation covering a wide field of inorganic chemistry with particular reference to water and fuel.

Applications to Establishments Officer, British Electricity House, Lower Ham Road, Kingston-on-Thames, by 18th December. 6507

## THE GENERAL ELECTRIC CO. LTD.
### Witton, Birmingham, 6

VACANCIES for DRAUGHTSMEN. The company offers varied and interesting careers to senior and junior draughtsmen experienced in any of the following:—

SWITCHGEAR: Airbreak circuit breakers; H.T. circuit breakers and metalclad switchgear; switch and control board layout; industrial control contactor cubicles; diagrams.

ROTATING MACHINES: Large A.C. and D.C. machines, including turbo and waterwheel alternators.

Five-day week. Superannuation scheme. Excellent conditions. Apply giving full details to the Staff Manager. 6487

## SOUTH WEST SCOTLAND ELECTRICITY BOARD

### Ayrshire Sub-Area

APPLICATIONS are invited for the undernoted Engineering appointments:—

(a) GENERAL ASSISTANT DISTRICT ENGINEER, AYR DISTRICT. Applicants should preferably possess a Higher National Certificate in Electrical Engineering or its equivalent and have experience of operational work in an electricity supply authority.

Salary and conditions in accordance with the National Joint Board Agreement, Schedule A, Grade 11, Class E, £555/£600 per annum, subject to statutory deductions which include income tax and superannuation.

(b) JUNIOR ENGINEER, KILMARNOCK DISTRICT. Salary and conditions in accordance with the National Joint Board Agreement, Schedule A, Grade 13, Class E, £475/£520 per annum, subject to statutory deductions which include income tax and superannuation.

Forms of application may be obtained from the undersigned or any other Sub-Area Manager and should be returned to me duly completed with any additional information not later than 20th December, 1954..

A. E. ROOTS,
Manager.

Greenholm Street,
Kilmarnock.
29th November, 1954. 6468

## SOUTH WEST SCOTLAND ELECTRICITY BOARD

### Lanarkshire Sub-Area

### Appointment of General Assistant Engineer (Construction)

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER in the Sub-Area Construction Dept. at Hamilton.

Candidates should have had a sound electrical engineering training and have some experience of construction work appertaining to a large distribution system.

The salary and conditions of service will be in accordance with the National Joint Board's Agreement, Revised Schedule A, present classification and grading being K.13, salary £675/£720 per annum, which will be subject to the statutory deductions, including superannuation. The successful candidate will require to reside within a reasonable distance of the Sub-Area Office at Hamilton.

Application forms, which may be obtained from the undersigned, should be forwarded to this office within 14 days of the date of this advertisement.

DUGALD SMITH,
Manager.

137, Almada Street,
Hamilton. 6452

## SOUTH WESTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER, PLYMOUTH. Salary N.J.B. Class F, Grade 5, £840 to £900 per annum.

Duties include the construction, operation and maintenance of the distribution system, including protective gear, and the preparation of capital sanction applications. Candidates should have wide experience of the engineering side of the industry and knowledge of modern street lighting schemes is desirable. Corporate Membership of the I.E.E. would be an advantage.

Application forms from the Manager, Plymouth District, Armada Street, Plymouth, should be returned by the 22nd December, 1954. 6515

## ELECTRICAL ENGINEER-DRAUGHTSMAN URGENTLY REQUIRED

ASSISTANT ENGINEER-DRAUGHTSMAN, preferably with some experience of battery-electric traction units, D.C. switchgear, etc., required in design office of well-known manufacturers of fork lift trucks and battery electric vehicles.

Apply in confidence, giving full details of experience, qualifications, and salary required, to:

**Chief Designer,**
**AUSTIN CROMPTON PARKINSON ELECTRIC VEHICLES LIMITED,**
**Webb Lane, Birmingham, 28.** 224

## ELECTRICAL AND MECHANICAL ENGINEERS

SUNVIC CONTROLS LTD. (a subsidiary of Metropolitan-Vickers Electrical Co. Ltd.) have the following vacancies in their new Development and Production Units at Harlow.

(1) GRADUATE ENGINEER with general works training and experience on the design of domestic control equipment. Applicants must be familiar with modern methods of manufacture and have some knowledge of mass production techniques.

(2) GRADUATE ENGINEER with experience in design or development of electro-mechanical mechanisms and their application to instrument problems.

The above positions are permanent and offer excellent prospects for promotion in a team engaged on the development and manufacture of a wide range of new instruments. Salaries will be according to age and ability. The company's contributory pension scheme applies in all cases, and housing is available if required.

Reply in writing, giving full particulars of age, experience, qualifications and present situation, to Chief Engineer, Sunvic Controls Ltd., Harlow, Essex. 230

## BRITISH ELECTRICITY AUTHORITY

### South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. appointments:

DIVISIONAL LABORATORY, UPPER BOAT POWER STATION (Vacancy No. 113/54). Junior Engineer (Chemist), male or female, in the Divisional Laboratory situated at Upper Boat Power Station. Salary AX/CX7, £475-£590.

Applicants should have had practical laboratory experience, preferably connected with water, fuel and oil. Possession of H.N.C. (Chem.) desirable.

Closing date 20th December, 1954.

UPPER BOAT POWER STATION (Vacancy No. 115/54). Assistant Shift Charge Engineer. Salary H9, £755 × £15 to £800 per annum.

H.N.C. and regular apprenticeship desirable, experience in a modern generating station essential.

Closing date 24th December, 1954.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Road, Gabalfa, Cardiff. 6503

## MINISTRY OF EDUCATION

requires, for England only, H.M. INSPECTORS (men and women). Preferably under 50. Appropriate professional qualifications and teaching and practical experience desirable in architecture, clothing trades, food technology and catering, engineering (chemical, mechanical or production), management studies, metallurgy or mining.

Posts permanent and pensionable. Inclusive salary: London, £1,185 by 12 increments to £1,725 (men); £1,080 by 11 increments to £1,550 (women). Elsewhere slightly less. A few posts carry £100 allowance. Appointments may exceptionally be made above the minimum. Higher posts filled by promotion.

Application form from the Secretary (Inspectors' Section), Ministry of Education, Curzon Street, London, W.1. Closing date, 28th February, 1955. 6438

## CHIEF BUYER

APPLICATIONS are invited by an East Midlands electrical engineering company for the post of CHIEF BUYER.

Applicants must be capable of following budgetary arrangements and stock control systems, and preferably have held a similar post in the electrical engineering industry.

Contributory pension scheme.

Please write stating age, experience and present salary to—Box 2J.M.3362, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2.

6474

## BRITISH ELECTRICITY AUTHORITY

### Midlands Division

APPLICATIONS are invited for the following positions at Hams Hall Power Stations. N.J.B. service conditions, superannuable appointments, salaries within Schedule A of the Agreement:—

(a) FIRST ASSISTANT STATION CHEMIST, Grade L.9, commencing at £900 per annum (Vacancy No. 834MD.).

(b) SECOND ASSISTANT STATION CHEMIST, Grade L.11, commencing at £790 per annum (Vacancy No. 835MD.).

Applicants for these positions should have had experience in the analysis of fuel, waters, and oils, as applicable to modern H.P. power stations. A knowledge of modern methods of water treatment, and of the control of boiler water conditions is desirable. The minimum qualification required is Higher National Certificate in Chemistry or its equivalent.

Apply, quoting the vacancy number, on form A.E.6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 29th December, 1954. 6520

## SOUTH EAST SCOTLAND ELECTRICITY BOARD

### Southern Sub-Area

FARM SALES REPRESENTATIVES for Berwick and Hawick Districts. Salary scale £485/£545 p.a. with placing according to qualifications and experience. Candidates should have experience in the applications of electricity in farm and garden, and general electrical and farming background knowledge.

Applications, stating age, qualifications and experience, should reach the Board at High Street, Galashiels, by 18th December, 1954.

FOREMAN for Meter Test Department, Galashiels. Applicants should have experience in overhaul, repair and calibration of all types of electricity meters and instruments, and should be capable of supervising the routine work of a Class A Polyphase Testing Station. N.J.I.C. Grade 3, £505 per annum.

Application, stating age, experience and qualifications, should reach the Board at High Street, Galashiels, by 21st December, 1954. 6522

## TECHNICAL INSTRUCTOR (ELECTRICAL)

required for NIGERIA for two tours of 15-24 months or three tours of 10-12 months, with option of appointment either (a) on agreement with prospect of permanent and pensionable employment in salary scale (including expatriation pay) £750 rising to £1,175 a year, or (b) on temporary contract in salary scale (including expatriation pay) £807 rising to £1,269 a year with a gratuity at rate of £100/£150 a year. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K. Liberal leave on full salary.

Candidates, under 40 years of age, must have served an apprenticeship to electrical engineering and be experienced practical tradesmen. They must hold a C. & G. or other recognised technological certificate and have had experience in apprentice training.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2A/29963/EF. 6523

## BRITISH ELECTRICITY AUTHORITY

### South Western Division

STATION SHIFT CONTROL ENGINEER required at Feeder Road Generating Station.

Superannuation scheme. Salary N.J.B. Class E, Grade 10, £595-£640.

Applicants should possess good technical qualifications, and have had training and experience in the control and operation of steam generating plant and main switchgear.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 20th December, 1954. 6517

## EAST MIDLANDS ELECTRICITY BOARD

### Derby and Burton Sub-Area

APPLICATIONS are invited for the appointment of a GENERAL ASSISTANT ENGINEER in the Derby District of the Derby and Burton-Sub-Area.

The salary and conditions for the post will be in accordance with the National Joint Board Schedule, Class G, Grade 9, at present £715-£760 per annum.

Applicants should have a technical qualification equivalent to the Higher National Certificate in Electrical Engineering, and have experience in the construction, maintenance and operation of high and low voltage networks.

The successful candidate will be required to undertake standby duties and to reside in or near to Derby.

Applications for the above post, stating age, qualifications and experience, present post and salary, should reach F. H. Pooles, Esq., M.I.E.E., Sub-Area Manager, 36, Full Street, Derby, and be received within 14 days of this advertisement. 6472

## BRITISH ELECTRICITY AUTHORITY

### South West Scotland Division

### Maintenance Engineer (Electrical), Kilmarnock Generating Station

APPLICATIONS are invited for the position of MAINTENANCE ENGINEER (Electrical) at Kilmarnock Generating Station.

Applicants should have received a good technical education and have extensive experience of electrical equipment and the organisation of maintenance in a power station. The salary will be Grade 6, Class F of Schedule A of the N.J.B. Agreement. A house may be available.

Applications on Form AE.6, which may be obtained from Divisional Headquarters or any Divisional Office of the Authority, should be forwarded to the Divisional Secretary, 168, Broomhill Drive, Glasgow, W.1, before Friday, 24th December, 1954.

A. CHRISTIANSON,
Divisional Secretary.
6469

## BRITISH ELECTRICITY AUTHORITY

### North West, Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of SENIOR DRAUGHTSMAN (Mechanical) in the Liverpool Office of the Construction Department, Springwood House, Liverpool. Salary £640/£740 per annum, Grade 5, Schedule D to the National Joint Board Agreement. Superannuable and subject to medical examination.

Applicants should have had a good general and technical education, preferably possess the Higher National Certificate in Engineering, and have had some experience in a drawing office associated with the construction of modern power stations or allied plant. The successful applicant will be required to prepare drawings and diagrams associated with power station plant and equipment, and check drawings and diagrams submitted by contractors.

Application forms from the Divisional Controller, Beaconsfield Road, Woolton, Liverpool. Closing date, 31st December, 1954. 6485

## VERITYS LIMITED

### Aston, Birmingham

DRAUGHTSMEN, SENIOR & JUNIOR, wanted for switch and automatic control gear.

SENIOR: Only men with a sound practical modern outlook, capable and willing to accept responsibility, will be considered for this appointment. Technical qualifications should be up to H.N.C. standard.

JUNIOR: Applicants should have had some drawing office and practical training, with technical qualification up to O.N.C., although this latter is not essential.

In the first instance replies should be by letter addressed to the Manager, Controller Department, stating experience and qualifications, together with age and salary level. 6300

## BRITISH ELECTRICITY AUTHORITY

### Eastern Division

APPLICATIONS are invited for the following appointments in the Generation (Construction) Department at Divisional Headquarters:—

SENIOR DRAUGHTSMEN
(Mechanical).

Salary Schedule D, Grade 4, £787 × £20 to £892 per annum.

The commencing salary will depend upon experience and qualifications. Applicants should preferably have experience in generating station plant layout and design of pipework, coal, ash and dust handling systems, etc.

Applications, stating age, qualifications and experience, should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London, N.14, by 23rd December, 1954.

W. N. C. CLINCH,
Controller. 6484

## ELECTRICAL ENGINEERS AND PHYSICISTS

THE GENERAL ELECTRIC COMPANY LIMITED, Witton, Birmingham, 6, has vacancies for ELECTRICAL ENGINEERS and PHYSICISTS, age 23 to 30, possessing a degree or Higher National Certificate, and with some practical engineering experience, for design, development and experimental work on rotating machines, switchgear, transformers and rectifiers.

Prospects for advancement are excellent.

Applications, which will be treated as confidential, should be addressed to the Staff Manager, stating age, qualifications and experience.

6373

## BRITISH ELECTRICITY AUTHORITY

### Yorkshire Division

SENIOR DRAUGHTSMAN (Mechanical) required in the Generation Construction Department, Leeds.

Salary £640-£740 per annum, Grade 5, Schedule D, N.J.B. Agreement.

Applicants should be experienced in heavy engineering and power station construction, especially the installations of H.P. plant and pipework.

Application forms obtainable from Divisional Secretary (Establishments), British Electricity House, St. Mary's Rd., Leeds, 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
6508

## CONTACTOR SWITCHGEAR LTD.

ENGINEERS required for both engineering and estimating departments for control gear applications up to 1,000 h.p. low and high tension.

The company operates a contributory pension scheme and will share cost of removal in approved cases.

Applicants should have completed their National Service and preferably not over 45.

Write in confidence, stating age, experience and salary required, to the Secretary, Blakenhall, Wolverhampton. 6402

## SIMPLEX ELECTRIC CO. LTD.

require an experienced REPRESENTATIVE for the North-East Midlands. Must be fully conversant with modern installation practice and able to develop the sale of the company's products in this field.

Preference will be given to an applicant who is a car owner and is resident in the Derby/Nottingham district.

Applications stating age, qualifications and salary required should be made to The Secretary, Simplex Electric Co. Ltd., Oldbury, Birmingham. 6454

### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of SERVICE CENTRE SUPERVISOR at Warrington. Salary within the range £670/£730 p.a. (N.J.C. Grade 5).

Applicants should have had a sound training on the commercial side of an electricity undertaking or in the electrical retail trade, and must have a wide knowledge of modern electrical appliances for commercial and domestic use.

The duties will include the supervision and control of the service centre, the display of apparatus, hire purchase transactions, and receipt of accounts.

The appointment is superannuable and subject to medical examination.

Applications, stating age, experience, qualifications and present appointment, should be sent to the Manager, No. 2 Sub-Area, MANWEB, Sandiway House, near Northwich, Cheshire, not later than 17th December, 1954. 6470

### ROYAL AIRCRAFT ESTABLISHMENT

**Farnborough, Hants**

DRAUGHTSMEN AND LEADING DRAUGHTSMEN required for individual design work. Candidates must have served engineering apprenticeship or equivalent workshop training, have O.N.C. and good drawing office experience. For leading draughtsmen posts, preference given to holders of H.N.C.

Salary up to £742 p.a. according to age, qualifications and experience. 5-day week of 44 hours including meal breaks. Paid sick leave. 4 weeks' annual holiday, plus public holidays.

Write, giving age, qualifications and experience, to Ministry of Supply, Est. 3(c), Carlton Hotel, Haymarket, London, S.W.1, quoting A/P. 6473

### ELLIOTT BROTHERS (LONDON) LIMITED

CONTRACTS MANAGER
is required for the
AVIATION DIVISION
of the above company.

Knowledge of Air Ministry contracts procedure and costing and estimating systems, together with experience of all aspects of factory routine is essential. Preference will be given to men with engineering qualifications and background and the ability to complete negotiations at an executive level. Applications giving full particulars of age, experience, qualifications and stating salary required to:—

**Personnel Officer, Century Works, Lewisham, London, S.E.13.** 6295

### WEST SUSSEX COUNTY COUNCIL

**County Architect's Department**

APPLICATIONS are invited for the appointment of a TEMPORARY ASSISTANT ELECTRICAL ENGINEER-DESIGNER-DRAUGHTSMAN at a salary between £600 and £725 per annum, according to experience, for a minimum period of two years, subject to satisfactory service.

Further particulars should be obtained from the County Architect, County Hall, Chichester, to whom detailed applications must be submitted not later than the 5th January, 1955.

T. C. HAYWARD,
Clerk of the County Council.

County Hall,
Chichester.
1st December, 1954. 6504

### DEPUTY CHIEF ENGINEER

REPUTABLE and long-established London company with 1,000 employees, engaged in quantity production of precision electric instruments, mechanisms and other products, requests applications for the above post from suitably qualified engineers aged 35/45, with experience in research, development and executive direction in the field of metering, instrumentation and electronics. Salary scale £1,500-£2,000 per annum; pension scheme.

Send particulars to the Managing Director, Box 6228.

### SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT ENGINEER, Folkestone District. Salary £635-£680 p.a. under N.J.B. Class D, Grade 8. Superannuable.

Applicants must have had a sound practical training and experience in the design, construction, operation and maintenance of H.V. and M.V. overhead and underground distribution systems, substation plant and ancillary equipment, and preferably hold the Higher National Certificate, or its equivalent in Electrical Engineering.

Applications, naming 2 referees, to P. V. Gurr, J.P., District Manager, SEEBoard, York House, Cheriton Gardens, Folkestone, Kent, by 22nd December, 1954.

A. L. BURNELL,
Secretary. 6514

### QUALIFIED ENGINEER

ABLE young QUALIFIED ENGINEER required by CIBA LABORATORIES LIMITED for their rapidly expanding modern pharmaceutical factory in Sussex. Opening provides scope for substantial development. Age under 35. Excellent conditions of employment, including pension fund. Initial help with housing for married man. Send details of education, qualifications, industrial experience and salaries earned to

**Works Manager**
**CIBA LABORATORIES LIMITED**
**Horsham, Sussex**
6525

### BRITISH ELECTRICITY AUTHORITY

**Midlands Division**

MAINTENANCE ENGINEER (Mechanical) is required at Walsall and Birchills Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade H.6, commencing at £900 per annum.

A sound technical training and practical experience in modern power station mechanical maintenance is required, and the possession of appropriate technical qualifications will be an advantage.

Apply, quoting vacancy number 836MD on form A.E.6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham 13, by 29th December, 1954. 6518

### MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR ASSISTANT ENGINEER (Operation) required at No. 1 Sub-Area Headquarters, 24, Hatton Garden, Liverpool, 3. Salary £1,295 × £35 to £1,400 (N.J.B. L/4).

Applicants should be chartered electrical engineers and should have had wide experience in the maintenance and operation of large transmission and distribution networks up to and including 33 kV.

The appointment is superannuable and subject to medical examination.

Special application forms, obtainable from the Manager, above address, should be returned not later than 20th December, 1954. 6453

A DRAUGHTSMAN, preferably under 30 years of age, with experience of light electro-mechanisms, instruments, or both, is required for a small team engaged in the design and manufacture of special-purpose apparatus. A sound background of workshop experience is essential. The appointment is at the applicational research centre of a major oil company near Chester. Starting salary according to age and experience; attractive pension benefits. Write giving full details to — Box ZO.100, Deacon's Advertising, 36, Leadenhall Street, London, E.C.3. 6492

A LARGE industrial organisation has a vacancy for an electrical draughtsman at their head office in London. Some knowledge of electrical circuits for power and lighting installations and electrical plant layout in factories is desired, also the theory connected with such installations. Aged 22/26. Reply in the first instance, stating education, age, experience and salary required, to—Box AM3567, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. 6493

A SENIOR technical designer with first-class experience of the design of electrical accessories is required in London by The General Electric Co. Ltd. Wide experience in a works design office is essential, together with the ability and keenness to make a real contribution to the developments of the company's electrical accessories. Applications giving full details of record and experience should be addressed to the Staff Manager (Ref. ELS), The General Electric Company Ltd., Magnet House, Kingsway, London, W.C.2. 6530

A WELL-known company manufacturing electrical rotating machinery 1-100 h.p. has a vacancy for a senior sales engineer based on their London office. The successful applicant must be trained electrical engineer with Ordinary National Certificate as a minimum qualification and with previous experience in the London or South-Eastern Counties area. The post carries a responsibility for the organisation and control of three sales engineers. A generous salary is offered, together with non-contributory pension scheme.—Box 6489.

A WELL-known electrical company has a vacancy for a senior fusegear sales engineer. Applicants must be trained engineers with Ordinary National Certificate as minimum qualification and have extensive commercial experience in this field. A generous salary is offered, together with non-contributory pension scheme.—Box 6490.

AN experienced D.C. designer capable of using his initiative required for interesting work on dynamo electric machines from 5 to 5,000 h.p./kW. A superannuation scheme in operation and the usual social amenities available in an organisation of progressive outlook. All applications will be treated with the strictest confidence and should be addressed to—The General Manager, Lancashire Dynamo & Crypto Ltd., Trafford Park, Manchester, 17. 6219

AN old-established E.W.F. wholesaler has a vacancy at their London branch for a young man to assist in their order department. Applicant should have some knowledge of the electrical trade and should not be afraid of hard work.—Box 6358.

APPLICATIONS are invited by the General Electric Co. Ltd. from young men who are interested in the selling of light engineering equipment. Applicants should not be over 30 years of age, and have had previous experience in a sales organisation. Preference will be given to those who have studied electrical engineering. The positions offer good opportunities for advancement. Apply in writing, quoting ref. E.S.V., to—The Staff Manager, Magnet House, Kingsway, London, W.C.2. 6477

APPLICATIONS are invited for the post of technical engineer in the sales department of Messrs. Igranic Electric Co. Limited, Bedford (a company in the Metal Industries Group). An O.N.C. in electrical engineering is a minimum requirement; practical experience in estimating and quoting for all types of A.C. and D.C. contactor equipment desirable, although training can be given to applicants having a suitable background. Age 25-35. Please apply in writing, stating age, qualifications, salary required, etc., to — The Group Training and Personnel Officer, Metal Industries Limited, 60, Buckingham Palace Road, London, S.W.1. 6475

ASSEMBLERS, experienced manufacture and repair small fractional h.p. motors. London district.—Box 6414.

ASSISTANT electrical designer for induction motors required for our Norwich works. Applicants should have completed or be exempt from National Service. Write, giving full particulars, to — The Secretary, Laurence, Scott & Electromotors Ltd., Gothic Works, Norwich, Norfolk. 6359

ASSISTANT required for electrical contractor's office, state age and experience. Write—Staff Manager, 1, Emerald Street, London, W.C.1. 6532

CAPABLE measurer required for duties on Air Ministry electrical schedule contracts in East Anglia. Must be prepared to become permanently resident in area and, if possible, car owner. Some electrical qualifications will be an advantage. Full details to—Box 6441.

CROMPTON PARKINSON Ltd., Chelmsford, Essex, have vacancies for draughtsmen in drawing office engaged in design and development of industrial indicating instruments. Applicants should state age, experience and salary required to the Personnel Officer. 6340

BIRMINGHAM manufacturer of electrical products requires energetic man aged 30-40 in sales department to handle correspondence, sales records, despatch of orders, etc. Must reside in or near Birmingham and have knowledge of up-to-date office systems and machines. Apply in confidence stating age, experience and salary required to—Box 6456.

BOOTS PURE DRUG Co. Ltd., require an electrical engineering draughtsman, age 25-30. Salary £500-£600 per year, according to qualifications and experience. Five-day week, superannuation scheme. Applications in writing, to—Personnel Manager, Station Street, Nottingham. 6533

CONTRACTS engineer required by company in South Wales manufacturing electrical rotating machinery 1-100 h.p. Applicants for preference should have served a recognised apprenticeship and possess O.N.C. as minimum qualification. At least three years' experience in a commercial department is required. A generous salary is offered, together with non-contributory pension scheme.—Box 6491.

COOKE & FERGUSON Limited, switchgear specialists require sales engineers for engineering of schemes and preparation of tenders for indoor and outdoor switchgear. A knowledge of protection is essential and applicants must be qualified in electrical engineering to at least H.N.C. standard. Superannuation scheme in existence. Salary commensurate with qualifications and experience. Please reply stating age, experience and qualifications, to—Personnel Officer, Saxon Works, South Street, Openshaw, Manchester, 11. 6416

CROMPTON PARKINSON Ltd. invite applications from senior and junior switchgear engineers for posts in their Chelmsford works. Vacancies exist in both contract and tender sections of the switchgear department. State age, experience, qualifications and salary required to—The Personnel Officer, Crompton Parkinson Ltd., Chelmsford, Essex. 239

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer for interesting work in connection with the development of automobile electrical equipment. He should be at least of H.N.C. standard and experience in the design of light electrical equipment for large quantity production would be an advantage. A good starting salary will be paid and the position provides excellent scope for advancement. In addition, design and detail draughtsmen are also required for the design of aircraft and automobile wiring systems, and applicants for these positions should have experience in the layout of electric circuits. Please reply stating age, qualifications and experience to—Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, quoting ref. PM/D/41. 143

DESIGN engineer with electro-mechanical experience, and preferably knowledge of railway traction conditions, is offered interesting and rewarding opportunity to head up rapidly expanding section engaged in research and development of electro-mechanical speed indicating and recording equipment and tachometer applications generally. Applicants are sought with initiative, sound technical background, experience in this field, and the ability to initiate designs and to carry through to production stage. This is a senior position carrying a substantial salary. Applications, giving fullest particulars, to—Personnel Manager, Elliott Bros. (London) Limited, Century Works, Lewisham, London, S.E.13. 6360

DEVELOPMENT engineer reqd. for work in conjunction with magnetic amplifiers as applied to power engineering. S.E. London factory. Shortly moving to Crawley, Sussex, where house will be available. Write stating full details to—Box 6442.

DRAUGHTSMAN required by prominent firm in West London for preparation of lighting and power schemes for all types of buildings. Pension scheme, social and sports facilities. Apply stating age, experience and salary required to—Box 6443.

DRAUGHTSMAN required for work on design of high voltage cable accessories in the Shepherd's Bush (London) area. A knowledge of mechanical engineering desirable and electrical engineering essential. 5-day week. Pension fund. Apply in writing stating age, qualifications, experience, salary required, and quoting reference number L/64/54, to—Staff Officer, British Insulated Callender's Cables Limited, 21, Bloomsbury Street, London, W.C.1. 6524

DRAUGHTSMAN, detail, age 25 years or over, experienced in detailing switchgear panels an advantage. Apply—Personnel Manager, Simplex Electric Co. Ltd., Broadwell Works, Oldbury, Birmingham. 6494

DRAUGHTSMAN required by consulting engineers for the reproduction of electric light and power schemes. Previous experience essential. Write, stating age, experience and salary required, to—E. Wingfield-Bowles and Partners, 32, Old Queen Street, Westminster, London, S.W.1. 157

DRAUGHTSMAN with experience of electro-mechanical instrumentation required immediately for interesting work in connection with government and commercial requirements in new and pleasant drawing office. National Certificate an advantage but not essential. Excellent conditions, pension scheme, 5-day week. Apply to General Manager, Hendrey Relays Limited, 392, Bath Road, Slough, Bucks. 6534

DRAUGHTSMEN required for automatic electric control gear; 5-day week; excellent working conditions; canteen facilities; convenient transport; incentive bonus; superannuation scheme; salary according to qualifications, ability and experience. Apply — Asst. Sec., Watford Electric & Mfg. Co. Ltd., Watford, Herts. 6234

DRAUGHTSMEN required for mechanical design of compressed air components. Some mechanical experience essential. Applications giving details of experience, age, etc., should be addressed to—Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17. 217

DRAUGHTSMEN. Suitable qualified young men are invited to apply for work in connection with electrical control gear in the applications drawing office (London) of Messrs. Brookhirst Switchgear Limited. The staff of this office cover a wide range of work and the posts offer a valuable opportunity for promotion to technical and/or sales engineering work. Please apply giving full details to—The Manager, Power Applications Branch, Brookhirst Switchgear Limited, 60, Buckingham Palace Road, London, S.W.1. 6476

ELECTRICAL assistant (junior) urgently required by old-established firm of lifting gear manufacturers. Drawing office experience and good knowledge of industrial control gear application is essential. Permanent, progressive, pensionable post to right man. Apply—Dept. ED, The Vaughan Crane Company Ltd., West Gorton, Manchester, 12. 6495

ELECTRICAL draughtsman required, capable of setting out power and lighting installations, with all diagrams, etc. Apply stating age, with copies of references, to—Box 6419.

ELECTRICAL engineer required, age about 25/30 years, to assist in the design of electrical installations and purchasing of electrical equipment for gasworks and coke oven plants. Ordinary National Certificate or higher qualifications required, and experience of handling technical correspondence, with a knowledge of motor control gear, and/or designing electrical power and lighting distribution systems. Five-day week. Canteen. Apply by letter, giving details of past experience and salary required, to—The Personnel Officer, Woodall-Duckham Construction Company Ltd., 63/77, Brompton Road, London, S.W.3. 6496

ELECTRICAL engineers. English Electric have a vacancy at Rugby for a qualified electrical engineer to assist in interesting development work on electro-hydraulic governors. Some experience of magnetic amplifiers would be a great advantage. Please write giving full details to—Ref. 1050D, Dept. C.P.S., 336/7, Strand, London, W.C.2. 6449

ELECTRICAL engineers. McLellan and Partners, consulting engineers, have a few vacancies for young engineers interested in industrial work. Applicants must have a degree or equivalent and be trained by one of the larger electrical manufacturers. Reply to—32, Victoria Street, London, S.W.1. 6478

ELECTRICAL wholesaler requires the following additional staff: Order clerk, also pricing clerk; knowledge of trade essential. Storesman with good knowledge of electrical equipment.—London Electrical Co., 92, Blackfriars Road, London, S.E.1. 6215

EXPERIENCED storekeeper, electrical trade. Good wages and prospects for man with initiative.—Western Dynamo and Motor Co., Summerland Street, Exeter. 6537

ELECTRICAL estimator. Simon-Carves Ltd. have a vacancy for an estimator, aged 30-40, with previous experience in heavy electrical engineering. A sound technical background and some drawing office experience are essential. Initial salary will depend on age and qualifications, but will not be less than £600. Working conditions and scope are good and there is a pension fund in operation. Write, quoting ref. HV.61, to — Staff & Training Division, Simon-Carves Ltd., Cheadle Heath, Stockport. 6444

ELECTRO-mechanical engineer with commercial bias and preferably experience in railway traction conditions is offered first-class opportunity to develop and expand sales of electrical speed indicating and recording equipment of all types. Ability to co-operate fully with design and production staff, a real sense of purpose and drive will be rewarded with first-class salary and every opportunity of further progress within a rapidly expanding organisation with world-wide ramifications and connections. Applications giving fullest details to—Box E.R.596, c/o 191, Gresham House, London E.C.2. 6357

ENGINEER, aged 22/35, required by cable company in London area for testing and maintenance of electronic equipment in new instruments for automatic testing of telecommunication cables. Apply giving full particulars to—Box 6500.

ENGINEER, aged 25/35, with electrical or physicist degree required by cable company in London area for development work on testing equipment for telecommunication cables. Permanent and pensionable position at salary commensurate with experience and qualifications. Apply giving full particulars to—Box 6501.

ENGINEER required for electro-medical service department. Applicants should have knowledge of electronic circuits and be prepared to travel in Greater London area. Apply for appointment by letter or telephone. —General Radiological Ltd., Electro-Medical Department, 18, New Cavendish St., London, W.1 (Phone, Welbeck 1212). 6263

ENGINEERING draughtsman, senior, capable electrical layouts required by London firm engineers. Excellent opportunity progressive situation. Write age, references.—Box 6535.

ESTABLISHED firm seeks services of ambitious young man, fully experienced fractional h.p. motor winding, repair and manufacture, to start up and develop branch S.E. London. Salary and share of profits basis.—Box 6536.

ESTIMATOR required in sales department, experience in automatic control gear essential, some knowledge of tendering procedure desirable.—M.T.E. Control Gear Ltd., Leigh-on-Sea, Essex. 6265

F.H.P. motor development. English Electric, Bradford, wish to appoint an engineer to take charge of the mechanical development of electric motors and associated equipment for economic production. This is a new and interesting appointment for a fully qualified and experienced engineer. Please apply giving full details of experience and qualifications, etc., to Ref. 1161B, Dept. C.P.S., 336/7, Strand, London, W.C.2. 6529

FOREMAN winder to take control of repair shop. Accommodation provided if necessary. Apply—Priory Electric Service (Coventry) Ltd., 3, Lower Ford Street, Coventry. 6559

GENERAL manager. Engineers with extensive experience in the manufacture, design and sales of switchgear are invited to apply for the position of general manager of the switchgear department of a large electrical engineering company. The approximate age limits are from 35 to 50 years and the technical qualification required is university degree in electrical engineering, A.M.I.E.E., or H.N.C. in Electrical Engineering. Candidates without these technical qualifications but with exceptionally appropriate experience will be considered. Applicants must have served a recognised apprenticeship in electrical engineering and have had at least ten years' relevant experience. Extensive knowledge of modern machine shop practice, process engineering, rate-fixing and work study is required. The salary will be in the range £1,500 to £2,000 per annum, with very good conditions of employment, including participation in a non-contributory assurance scheme.—Box 6538.

GRADUATE mechanical engineer required to work on steam power plant design. Applicant must have at least five years' experience on the design and layout of modern high-pressure, high-temperature central stations. The company is now actively engaged in extensive plant extensions of 25 and 45 MW size, the latter 900 lb. 900° F. On a long-term basis opportunity is offered for advancement in both technical and executive lines of public utility work. Salary paid will be according to ability, academic qualifications and experience. Apply giving age, training experience and approximate salary required. Address applications to—N. T. Smith, Manager, Nova Scotia Light and Power Co. Ltd., Halifax, N.S., Canada. 6497

GRADUATES in electrical engineering or physics required by well-known cable manufacturers, near London, for research and development work on all types of H.V. cables. Pension scheme and other amenities.—Box 6457

IGRANIC ELECTRIC Co. Limited, Bedford, have a vacancy for a sales engineer in their Bristol office. Applicants should have served an apprenticeship in electrical engineering and have a knowledge of electric motor control gear. Previous sales experience an advantage but not essential, as training can be arranged. Age 25-35 years. Apply giving particulars of age, training, experience and salary required to—The Group Training and Personnel Officer, Metal Industries Limited, 60, Buckingham Palace Road, London, S.W.1. 6505

IMPERIAL CHEMICAL INDUSTRIES Limited, Metals Division, has vacancies at its Witton works for senior and junior electrical design draughtsmen with a good working knowledge of electronics for very interesting work on instrument installations in the non-ferrous metals industry. Application forms may be obtained from—Assistant Staff Manager, I.C.I. Metals Division, Kynoch Works, Witton, Birmingham, 6, quoting ENG/8. 6480

INVOICING and accounts clerk required by electrical contractor. Please apply in writing in first instance to—R. H. Foster, 16, Essex Road, Basingstoke. 6458

JOINTER (E.H.T.) required by London Electricity Board in O. & M. Branch of the South Eastern Sub-Area at Woolwich, London, S.E.18. N.J.I.C. rates and conditions, 4s. 1d. p.h. Application forms from Personnel Officer, 46, New Broad Street, London, E.C.2. Please enclose addressed envelope and quote ref. M/3663/R. 6527

JOINTER, first-class H.T., required by London firm for 12 months' contract overseas, excellent opportunity. Write age, experience, references.—Box 6216.

JUNIOR draughtsman required for contractor's office. Write—Staff Manager, 1, Emerald Street, London, W.C.1. 6531

LEADING Swiss electrical plant manufacturers require qualified electrical engineers to take up employment in Switzerland. Some knowledge German or French desirable. The duties attached to the different vacancies include: (1) Handling of tenders to, orders from and negotiations with clients in English-speaking countries, for general electrical plant, etc.; (2) Similar duties in connection with electrical drives and control gear; some knowledge German or French necessary; (3) Preparation of tenders and dealing with orders for traction material and mercury arc rectifiers. Good knowledge of German and possibly French necessary. Applications, stating personal particulars and full details of qualifications, experience, salary required, etc., to—Box 6539.

LONDON TRANSPORT require technical assistant in lighting section of Signal Engineer's Office, Earls Court, for preparation of drawings of lighting schemes and low-tension cable and electrical track equipment work. Qualifications: Ordinary National Certificate in Electrical Engineering or equivalent qualification; some experience and knowledge of lighting work; drawing office and railway experience advantageous. Salary £343 10s. at 21, rising to £613 10s., with additional payments for certain recognised qualifications; prospects of advancement. Certain free travel; medical exam.; contributory superannuation scheme after probation. Applications to Staff Officer (F/EV.517), London Transport, 55, Broadway, London, S.W.1. For acknowledgment enclose addressed envelope. 6498

LARGE D.C. machine design. English Electric, Bradford, has a vacancy for a senior engineer with experience in D.C. machine design of 1,000 kW range. These motors and generators have interesting and special application in a wide industrial field. This is a senior appointment carrying an attractive salary. Please apply in strict confidence to—Ref. 758H, Dept. C.P.S., 336/7, Strand, London, W.C.2. 6528

MAINTENANCE electricians required for steelworks plant in Cardiff. Knowledge of automatic control gear for A.C. and D.C. motors essential. Must be a member of E.T.U. Daywork on 44-hour week, but prepared to work shifts on 48-hour week.—Box 6333.

MANUFACTURERS of electrical insulating materials require a junior technical sales representative in the London area. Applicants should have had a sound technical education, preferably to H.N.C. standard, and apprenticeship with reputable electrical manufacturers or equivalent practical training. Age limit approximately 22-25. Permanent position and ample scope and prospects are offered to a young man with initiative and keen interest in commercial work. Write, in confidence, giving personal particulars, details of education and experience, to—Box 6343.

MECHANICAL engineer required by cable works for production machine experimental and development work. Minimum qualifications H.N.C. Age limits 30 to 40 years. The prospects are good and this is an opportunity for a man who likes to see the results of his ideas put into practice. Commencing salary according to qualifications and experience. Pension scheme. Apply in confidence, giving particulars in chronological order, to—Works Manager, Southern United Telephone Cables Ltd., Dagenham Dock, Essex. 6375

METHODS and motion study engineer required by manufacturers mass producing assemblies of small parts. Vacancy will suit man with practical outlook. No administrative routine. Write details experience, present salary. Location London, E.18.—Box 6311.

PHYSICIST or electrical engineer required as technical manager of a medium-sized company engaged in the manufacture of rubber and thermoplastic cables, to be responsible for the technical control of production and development of the company's products. Applicants should be graduates in physics or electrical engineering or hold equivalent qualifications, and must have wide experience of the electrical cable industry. Applications in writing, stating age, qualifications and experience and salary required, to be addressed to—Personnel Officer, St. Helens Cable & Rubber Co. Ltd., Trading Estate, Slough, Bucks. 6540

QUALIFIED design and development engineer required by small but expanding company manufacturing control switchgear, specialising in limit, micro and rotary switches, in Birmingham area. Excellent prospects for advancement. Write fully stating past experience, qualifications and age to—Box 6459.

SENIOR chemist required for development work on insulating materials. Experience in polymer chemistry or wood technology desirable. London area. Salary in accordance with age, experience and qualifications. Excellent prospects.—Box 6460.

STREET lighting section of manufacturing electrical engineers in City (London) requires assistant (25/30 years) to handle quotations in sales office. Applicants must have good knowledge of street lighting equipment. Superannuation scheme. 5-day week. Apply stating age, experience and salary required to—Box 6461.

SWITCHGEAR contracts draughtsman required for work on indoor and outdoor switchgear up to 33 kV. A.E.S.D. rates paid to experienced man. Superannuation scheme in existence. Reply stating age and experience, to—Personnel Officer, Cooke & Ferguson Limited, Switchgear Specialists, Victoria Street, Openshaw, Manchester, 11. 6417

SWITCHGEAR draughtsmen required, with knowledge of H.V. outdoor switchgear and/or 11-kV oil-immersed metal-clad gear. Interview expenses paid. Help given to obtain accommodation if necessary. Apply in writing, giving details of qualifications, experience and salary, to — Switchgear and Equipment Ltd., Banbury, Oxon. 6481

SENIOR estimator required with initiative and having experience in handling comprehensive enquiries involving rotating electrical machinery up to 5,000 h.p./kW. A superannuation scheme in operation and the usual social amenities available in an organisation of progressive outlook. Promotions inside and transfers to sales normally made from staff. All applications will be treated with the strictest confidence and should be addressed to—The General Manager, Lancashire Dynamo & Crypto Ltd., Trafford Park, Manchester, 17. 6218

TECHNICAL and advisory representative required to develop the sales of new electrical tapes (adhesive and heat-seal varieties). Must have first class connections with electric motor and transformer manufacturers throughout the country and the trade generally. First class salary and expenses to right man. Permanent position. Pension and profit-sharing schemes. Apply—Managing Director, P. P. Payne & Sons Ltd., Haydn Road, Nottingham. 6179

TECHNICAL assistants required for investigational work in connection with radio valve manufacture. Applicants should possess at least Higher National Certificate. Five-day week, modern welfare facilities, staff pension. Apply, giving full personal details, including age, qualifications and experience, to—Personnel Superintendent, The Edison Swan Electric Company Limited, Cosmos Works, Brimsdown, Enfield, Middlesex. 6462

TECHNICAL representative required for South Wales area, must have sound knowledge of power factor correction. Good salary and commission. Apply in first instance by letter to—Electrical Equipment (Cardiff) Ltd., Dumballs Road, Cardiff. 7771

TECHNICAL representatives, 25/35. Men of initiative, preferably B.Sc.Eng., required to handle enquiries for lab. and industrial heating equipment and to establish customer contact. Remuneration will be based on results. Write giving details of age, experience and present annual remuneration to—Electrothermal Engineering Ltd., 270, Neville Road, London, E.7. 6541

TECHNICAL writers are required by the English Electric Co. Ltd. at Stafford for work on switchgear, general heavy electrical engineering products and electronics. A good engineering or electronics background is required, together with previous experience of technical writing. The positions are permanent, progressive and pensionable, with attractive salaries to the successful applicants. Reply to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting ref. 1362B. 6450

THAMES to Tay. Sales representative required by progressive transformer manufacturers to cover the entire East Coast. Permanent position, good pay and pension scheme. Applicants with good engineering knowledge and clientele in the area should apply to—Box 6445.

THE ENGLISH ELECTRIC Co. Ltd., require a senior experimental engineer to develop and apply experimental stress analysis techniques on structural research problems appertaining to guided weapons. Applicants should hold a Degree in Physics or Engineering, or equivalent, and have three years' research laboratory experience, including experience on electric resistance and mechanical strain measuring equipment. Applications to—Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting ref. 1000E. 6412

TRADE counter assistant or charge hand required with knowledge of the electrical wholesale trade. Apply in first instance by letter to Superlamp Ltd., 24a, St. Giles High Street, London, W.C.2, giving full details of past experience and salary required. 6542

TRANSFORMER designer required by manufacturers in North-West London. All-round experience with electronic and power transformers up to 250 kVA essential. Housing assistance if required.—Box 6543.

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URGENTLY required by wholesale electrical distributor, Victoria Street (London), male clerk experienced in pricing invoices from office system.—Telephone Victoria 6465 for appointment. 6463

WELL-known electrical manufacturing company has a vacancy for a sales engineer for electrical rotating machinery in Sheffield. Successful applicant must be a trained electrical engineer with O.N.C. as a minimum qualification and with previous sales experience in the area covered. He will work from the company's existing branch office. Remuneration by salary and expenses. Non-contributory pension scheme.—Box 6446.

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Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

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ADVERTISER (37), 22 years' experience with leading electrical inst. manufacturer, 14 years as supervisor, desires responsible position.—Box 7767.

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A.C. and D.C. motors, all sizes, large stocks, fully guaranteed. — Milo Engineering Works, Milo Road, East Dulwich, S.E.22 (Forest Hill 2278-9). 102

A.C. and D.C. motors, new and reconditioned. Diesel alternator sets, generators, transformers, welders, plating equipment, switch and control gear, etc. Stock list post free.—Thos. W. Ward Ltd., Albion Works, Sheffield (Phone 26311, ext. 347). 248

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5506/9). 91

ALTERNATOR control panel cubicles, 1,000 kW, 500 kW, 250 kW, 150 kW, 3-phase, 400 volts.—Britannia Manufacturing Co. Ltd., 22 26, Britannia Walk, London, N.1. 23

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ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

ALTERNATORS, 30 kVA, unused, with switchgear, exciters, etc., six available, £65 each; 250-h.p. Allen West 220-volt D.C. switch panel, £15.—Box 6547.

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CIRCUIT breakers, 300 amps., 3-phase, 50 cycles, Crompton Parkinson clad type, floor mounting, 25 MVA rupturing capacity. Number available. — Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 21

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DIESEL generating sets, English manufacture, 3-phase, all sizes to 500 kW.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 16

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ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E. R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT Berleon fittings and control units Data on request.—H. Strong & Son Ltd., 20-21, Church La., London, N.W.10. 188

FLUORESCENT fittings and control gear for home and export. Wide range competitively priced. Catalogues from — Rada, 148-150, Curtain Road, London, E.C.2 (Shoreditch 8275, 4 lines). 237

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GENERATING sets, petrol engine-driven alternators, 220/240 volts, single-phase and 3-phase. — Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1. 19

GENERATING sets, petrol engine-driven dynamos, 110 volts and 220-440 volts, direct current. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 18

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IMMEDIATE delivery new 330-kVA, 400-volt, 3-phase, 50-cycle, 4-wire B.T.H. alternator direct coupled to 400-h.p. Paxman diesel engine, 1,000 r.p.m., complete with switchboard and A.V.R. control.—C. J. Ferguson & Sons Ltd., 33, Barbican, London, E.C.1 (Monarch 5474/5). 104

MERCURY switches are made by Hall, Drysdale & Co. Ltd., of 58, Commerce Road, Wood Green, London N.22 (Tel. Bow 7221). 182

MOTOR alternators, 2 kW, single-phase, 1,500 cycles, 2,500-r.p.m. alternator direct coupled 220-volt D.C. motor by Newton.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 28

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PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

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TRANSFORMERS all voltages up to 50 kVA. State requirements.—Powerco, Wandsworth Town Station, York Road, London, S.W.18 (VANdyke 5234). 148

UNIT heaters, industrial type wall mounting, 3 kW, any voltage, £12 each; 1½ kW, any voltage, £9 each; Thermostatic controllers, £1 15s. each. Trade enquiries invited.—Motorlec Ltd., 745, Old Kent Road, London, S.E.15. 6098

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221 City Rd., London E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

WELDING dynamos and welding sets for sale.—Britannia Manufacturing Co. Ltd., 22-26. Britannia Walk, London, N.1. 11

WELDING set, 400-amp. mobile double operator, Meadows engine, tandem, separate/parallel, weatherproof, almost as new, £175. Separate 150-amp., 1,440/2,000-r.p.m., 85/65-v. BB welding generators, £65, or complete stationary or mobile plants. — Powerco, Wandsworth Town Station Works, York Road, London, S.W.18 (VANdyke 5234). 146

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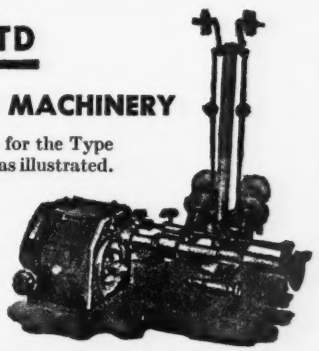

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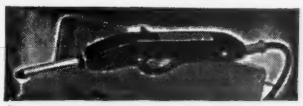

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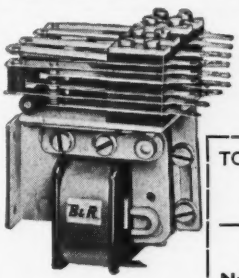

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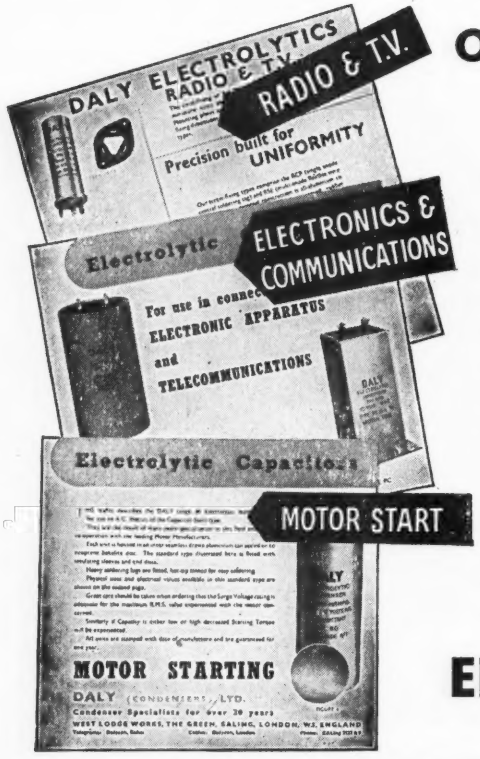


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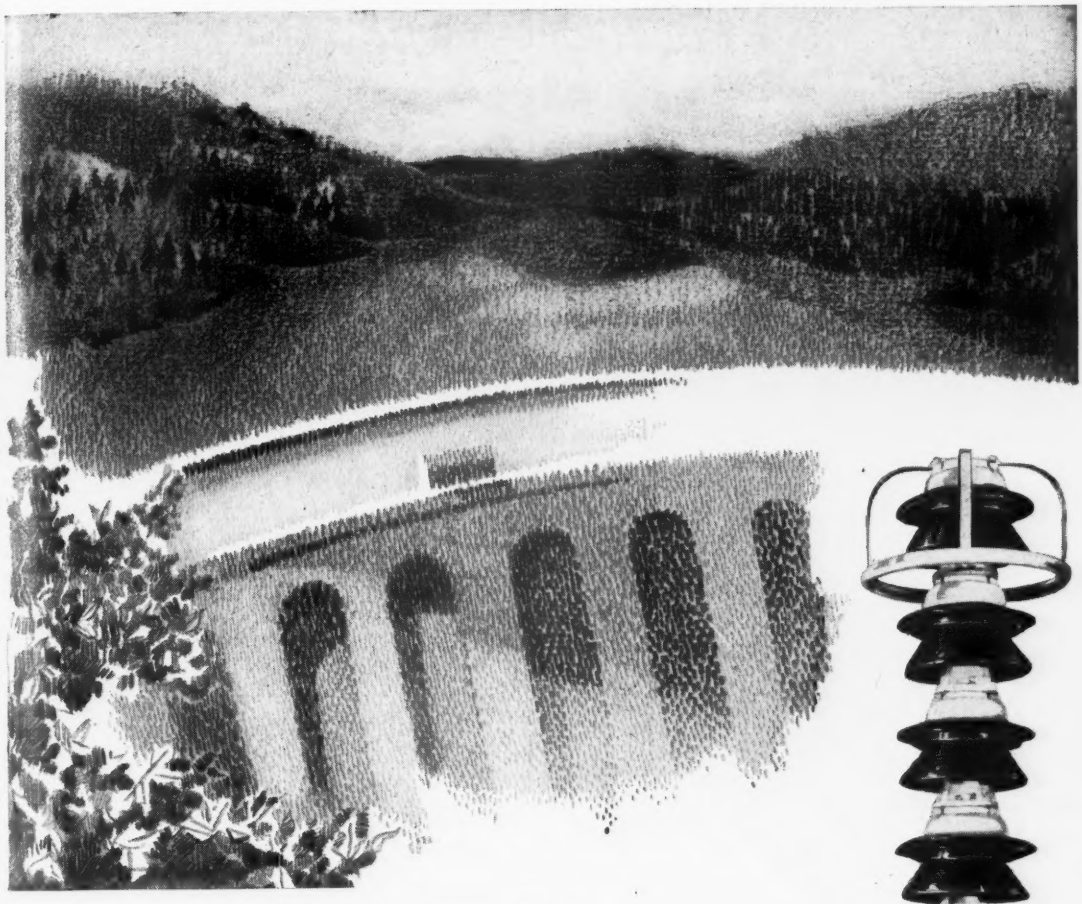

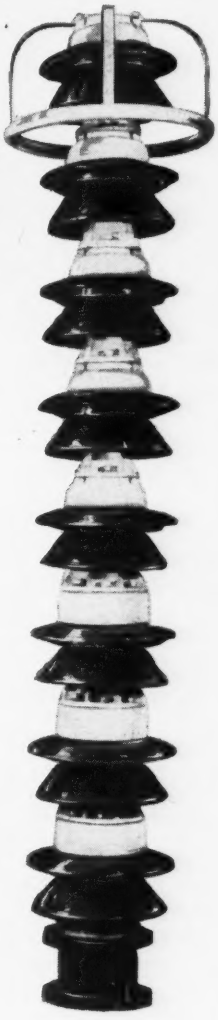

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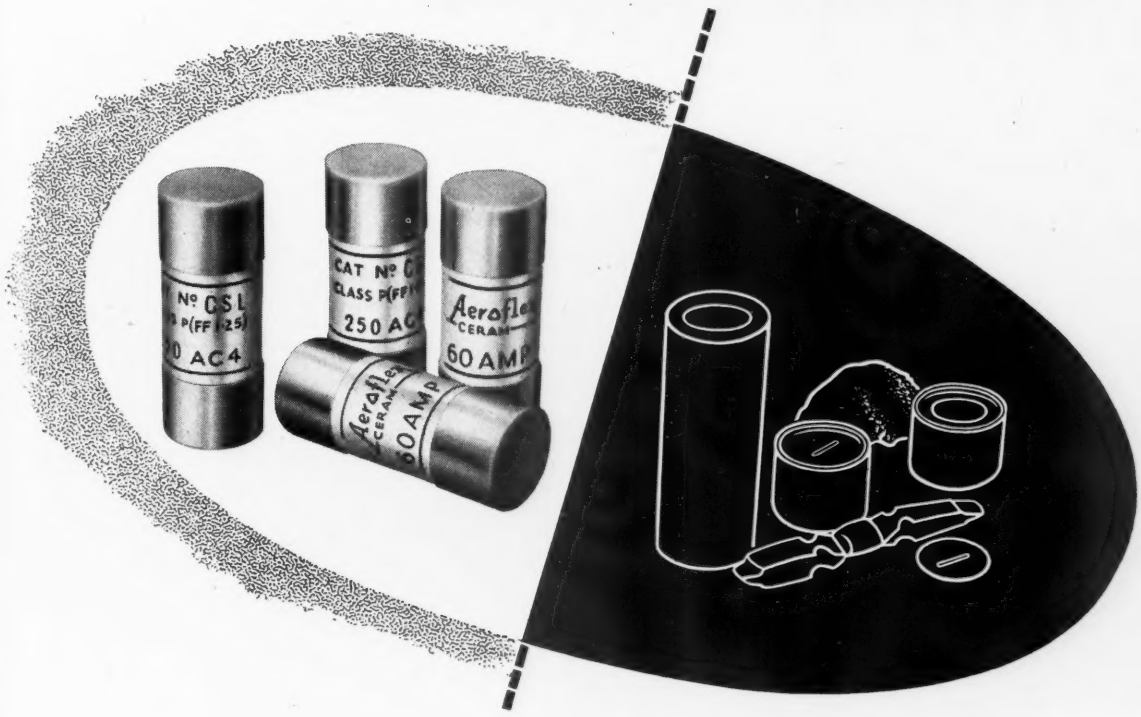


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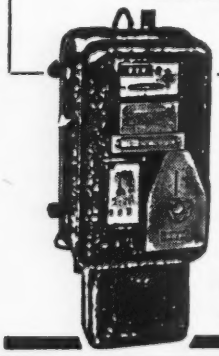

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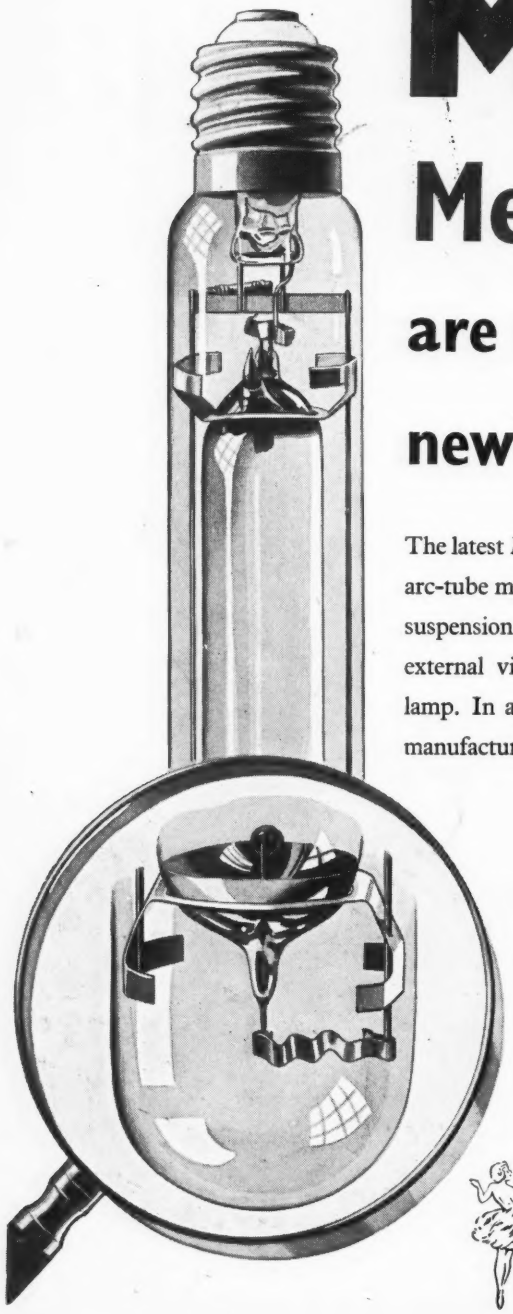

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